Minn Kota Service Manual

This manual is designed to assist in basic trouble shooting procedures.

Table of Contents

Safety Warnings			**ii**
Trouble Shooting Tips			**iii**
Chapter 1.	**Lower Unit / Motor Assembly** (includes DC motor theory, instructions to remove motor from composite shaft, and repair information)		**1-1**
Chapter 2.	**Depth Finder Interference**		**2-1**
Chapter 3.	**Universal Sonar – US1 & US2**		**3-1**
Chapter 4.	Hand-Control Models with a Speed Coil (5-speed models)		**4-1**
Chapter 5.	Hand-Control Models with a Printed Circuit Board (Variable-speed models, non-3X)		**5-1**
Chapter 6.	Hand-Control - **3X Steering**		**6-1**
Chapter 7.	Hand-Control - **Vantage**		**7-1**
Chapter 8.	Foot-Control - **PowerDrive** (PD) & **PD V2**		**8-1**
Chapter 9.	Foot-Control - **AutoPilot** (PD/AP) & **PD/AP V2**		**9-1**
Chapter 10.	Foot-Control - **Cordless PD/C & PD/AP/C**	(manufactured 1996-1999)	**10-1**
Chapter 11.	Foot-Control - **Terrova**		**11-1**
Chapter 12.	Foot-Control Cable Steer Models with a Speed Coil (5-speed **Maxxum**, **All Terrain**, & **Edge** models)		**12-1**
Chapter 13.	Foot-Control Cable Steer Models with a Control Board (Variable-speed **Maxxum** and **All Terrain** models)		**13-1**
Chapter 14.	Foot-Control - **Genesis**	(manufactured 2001-2003)	**14-1**
Chapter 15.	**PowerUp** Lifts, Trims, and Tilts	(manufactured 1996-2002)	**15-1**
Chapter 16.	**Engine Mount** (**EM**) & Neptune (**EP**)	(EP manufactured 1997-2002)	**16-1**
Chapter 17.	**DeckHand** Electric Anchors		**17-1**
Chapter 18.	**CoPilot** Wireless Accessory		**18-1**
Chapter 19.	**E-Drive**		**19-1**
Chapter 20.	**Battery Chargers**		**20-1**

SAFETY WARNINGS

- To prevent possible eye injury, always wear SAFETY GLASSES while servicing motors.

- Remove propeller from motor during test procedures to eliminate chances of being cut by rotating blades.

- Do not run motor out of water for more than a minute at a time. The motor assemblies (and speed coils) are designed to dissipate heat through the motor shell into water. The armature seals can also dry out.

- Follow all battery charging precautions to eliminate chances of the escaping fumes exploding.

Trouble Shooting Tips…

With all the new features and models being added to our Minn Kota line, motor troubleshooting and repair can be quite complicated. However, with circuit board costs rising, it is more important than ever to correctly diagnose the problem before replacing parts.

Here are a few trouble shooting suggestions:

- If possible, locate the failure before replacing any parts. Sometimes disassembly fixes the problem (pinched wires, poor connections, etc…).

- Look at the wiring as closely as you would the control board. There are as many problems with wires and connectors as with defective control boards. Check the coil cords on AutoPilot models. An open wire here will look like a bad board.

- On control boards with clear sleeves around the quick disconnects, be sure the female connector does not slip down beside the male connector. It may feel like the connector went on properly, but this connection will fail.

- For quick troubleshooting, use a 12-volt light bulb (automotive dome or brake light) with wires and alligator clips. Clip it to the board output and vary the speed to see if the board is working. A voltmeter on the output can sometimes be misleading. The control board needs some kind of load to work correctly.

- If you have replaced a board in the same motor more than once, this is probably a symptom of a larger problem. Check the wiring in the lower unit. (Shorts on the motor wires will cause board failures and shorts in PowerDrive drive housings will cause foot pedal board failures.)

- We still see control boards replaced under warranty that are NOT defective. To help us control costs to all our customers and to ensure that we will honor your warranty reimbursement claim, please be certain the board is defective.

- On AutoPilot motors, seldom do both boards fail at the same time. Please double check.

Chapter 1.

Lower Unit / Motor Assembly

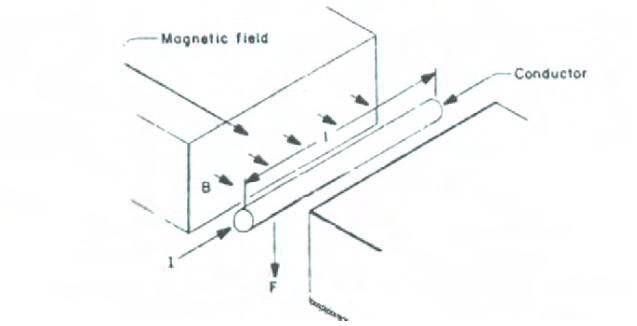
This chapter refers to the motor assembly only.

Like all motors, permanent magnet direct current (PM DC) motors are used to convert electrical power into mechanical power. Unlike other types of motors, permanent magnet motors convert power more efficiently. This is because a permanent magnet motor does not require electrical energy to create a magnetic field. Permanent magnets have this field already built-in, thereby reducing the consumption of electrical power by as much as 30%.

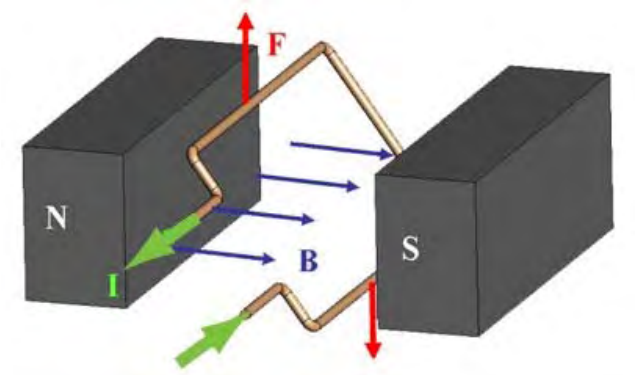
A permanent magnet DC motor consists of three main parts:

1. Current carrying conductors wound around a laminated iron core called an armature (or rotor).
2. A magnetic field provided by permanent magnets (or stator).
3. Some type of sliding contact arrangement for introducing current to moving conductors (usually carbon brushes and a commutator).

Understanding how an electric motor works is really quite simple, but first requires an understanding the basic principle of “electromagnetism”. This principle says simply that when current carrying conductors (“I” in the drawing below) are placed within a magnetic field (B), a force (F) will act on them.

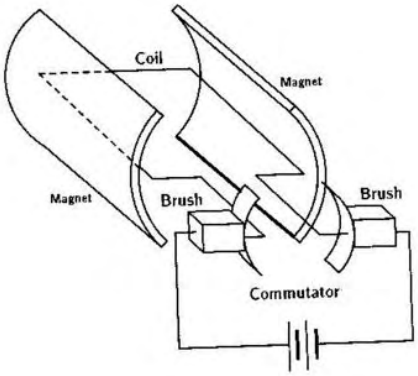


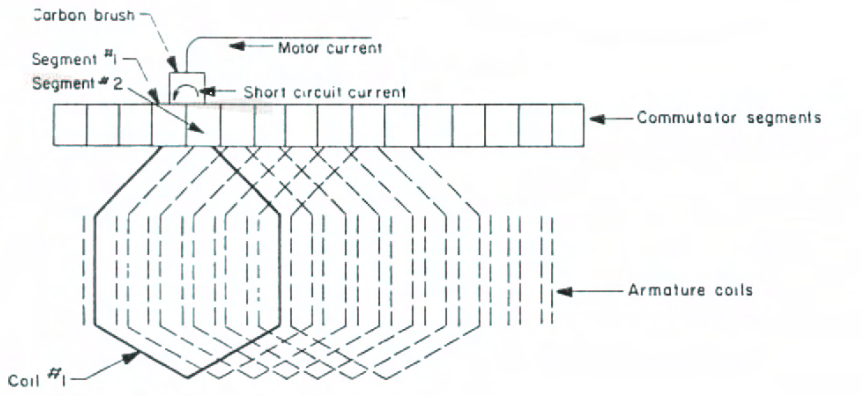
Now, imagine this single wire from the above picture is replaced with a loop of wire. Between the magnets' poles, this looks like two wires with current flowing in opposite directions. The forces on the wires cause the loop to rotate.



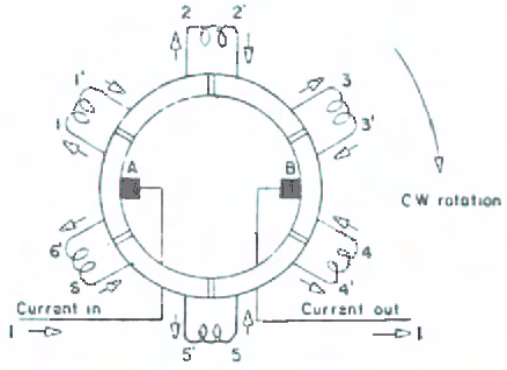
The process of switching current direction is called *commutation*. To switch the direction of current, brushed DC motors use *brushes* and *commutators*. The brushes are attached to the motor's two external wires, and the commutator segments slide over the brushes so that current through the coils switches at appropriate angles.

The following diagrams show how the brushes and commutator works together:





The connection of the coils to the commutator can also be shown something like this:



Current flow is in at brush A and out at brush B. The small radially-oriented arrows show current direction in the individual coil sides. If the rotation is clockwise, it can be seen that 1/6 of a revolution after the instant shown above, the current in coils 3-3' and 6-6' will have changed directions. As each successive commutator segments pass under the brushes, their current directions will also change. As a result of this switching, or commutation, current flow in the armature occupies a fixed position in space independent of rotation and a steady unidirectional force will result.

Instructions to Remove Lower Unit from Composite Shafts

Step 1. Tighten the shaft and lower unit assembly in a bench vise. Utilize the Tube Holding Block Set (Minn Kota P/N 2001022) to lessen chances of scarring the shaft. The motor assembly should be slid directly next to the block set.

Step 2. Heat the bung area with a commercial heat gun to loosen the LocTite. If you use a propane torch as a heat source, you risk blistering the paint. The heat needed to break down the LocTite is 450 degrees Fahrenheit for 5 minutes. We use LocTite 661 (with #7649 primer). If you cannot locate 661, 271 is more readily available and substantially less expensive. It will suffice for service work in the field.

NOTE: Be careful not to heat the shaft itself (this is the reason the tube blocks should be slid down directly next to the bung when clamped in the vise). While the composite shafts are very strong, the combination of heat and the twisting force can break them.

Step 3. Unscrew the lower unit from the shaft while hot. Once you break loose the LocTite, do not stop unscrewing or the LocTite may re-set.

Step 4. Clean the residue out of the threads of the lower unit with the hollow tap kit (Minn Kota P/N 2881021).

A. Slide the lower unit wires through the hole in the tap.

B. While holding the lower unit upside down, gently screw the tap into the motor assembly letting the residue fall out. Be careful not to cross-thread the motor.

Thru-bolt tightening specifications

- 3 ¼" motors = 25-35 inch pounds
- 3 5/8" motors = 35-45 inch pounds
- 4" motors = 40-50 inch pounds
- 4 5/8" motors = 40-50 inch pounds

End Play specifications

- Endplay should be .015" -.050", if necessary use extra nylatron washers. Too much or too little endplay will result in motor running hot or wearing out prematurely.

Case I. Lower unit does not run

Step 1. Check to ensure proper voltage. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Test lower unit directly (bypass all switches and/or control board).

A. Connect the lead wire to battery.

B. Hook the black battery lead directly to the black brush lead that exits the motor assembly.

C. Hook the red battery lead to red brush lead that exits the motor assembly. The motor should run. If not, a problem exists in the lower unit. Disassemble lower unit and check for voltage at the brushes, water damage, brushes not making proper contact, and an open armature.

C-1. An open armature will have some segments on the commutator that are dead. If the brushes happen to stop on this open segment, it will not run. If you can turn the prop a quarter and the motor starts and runs fine, the armature may have an open/dead spot. Replace armature.

Case II. Motor works on high speed, but missing some or all of the lower speeds

Step 1. Check speed coil functionality.

A. Connect battery lead wire to battery.

B. Hook the black battery lead directly to the black brush lead that exits the motor assembly.

C. Touch the red battery lead to each colored speed coil wire one at a time. The motor should run as you make each connection.

D. If the motor fails to run as you touch any of the colored speed coil wires, the problem is either speed coil is faulty and needs to be replaced or the speed coil jumper wire is not connected to the back of the brush plate (in the lower unit).

D-1. If the motor runs as you touch the red battery lead to some of the colored speed coil wires, but not all the speed coil wires, the speed coil is faulty and needs to be replaced.

Case III. Motor works at all speed settings, but the customer is complaining that there is no variation between speeds.

Step 1. Perform an amp draw check while the motor is running in a water test tank.

- **A.** If the amps step up as the speed setting increases, the motor is performing as designed.
- **B.** If the amp draw does not increase along with the speed settings check the amp draw of each speed directly through the speed coil:
  - **B-1.** Remove the control box cover. Disconnect wires from the foot pedal (if a foot-control motor) or at the switch in the control box (if hand-control) from the wires to the lower unit.
  - **B-2.** With the lower unit still in a water test tank, connect -12 volts to the black motor/brush lead.
  - **B-3.** Connect +12 volts to each colored speed coil wire coming up through the motor tube from the lower unit. The motor will run (on the separate speed designations) as you make each connection. Note the amp draw as you test the different colored wires.
    - **a.** If the amp draw does not vary as you make the different connections (with the lower unit still in a water test tank) replace the front end bell/potted speed coil assembly.
    - **b.** If the amp draw does vary as you make the different connections, replace the 5-speed switch.

Case IV. Customer complains of low power/thrust

Step 1. Check to ensure proper voltage. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Amp draw is a direct correlation to thrust. Test lower unit amp draw directly (bypass all switches and/or control board) while motor is under load in a water test tank.

- **A.** If amp draw meets specifications then the lower unit meets thrust specifications (amp specs are listed in the annual Minn Kota product brochures).
  - **A-1.** Possible problem in wiring, switches, or control boards of motor or in boat's supply voltage.
  - **A-2.** Test amp draw specifications with voltage through complete trolling motor (remove any plug the consumer/dealer may have installed on the leadwire) to determine if a trolling motor problem exists or if there is a supply voltage problem to the trolling motor.
- **B.** If amp draw is lower than stated specifications:
  - **B-1.** Inspect for water in lower unit.
  - **B-2.** Inspect brushes and armature for discoloration or other signs of overheating (smell burnt). Replace parts as needed.
  - **B-3.** Suspect low magnetism of motor shell. (Magnets lose power with time and usage.)
- **C.** If amp draw is higher than stated specifications:
  - **C-1.** Check for proper/even torque of thru bolts.
  - **C-2.** Check for shorted armature (commutator to armature shaft should not show continuity).
  - **C-3.** The center section with magnets could be partially demagnetized causing high amp draw.

Case V. Motor stops running while in use. Motor starts running again after it is pulled up out of the water and is placed back in the water, after the control box is struck, or after the prop is turned slightly.

Step 1. The malfunction listed above is most likely due to an intermittent or marginal electrical connection at the armature windings and commutator.

- **A.** Dis-assemble the motor lower unit. Inspect for water damage. If water is present, repair and replace parts, as necessary.
- **B.** Inspect the armature. Examine the commutator sections for discoloration and arcing caused by the brushes as they make contact with "good/live" commutator sections and "bad/dead" sections. Test armature commutator sections for continuity from one section to the next going around the circumference of the commutator.
  - **B-1.** Replace armature if severe arcing is noted or if no continuity is found when testing commutator sections.
- **C.** Examine commutator section "tangs" that connect armature windings to each commutator section. Each "tang" should be pressed down flush to the brush surface of the commutator section. If any space is noted between the "tang" and the commutator "face" the potential for an intermittent electrical connection exists and the armature needs to be replaced.

Case VI. Motor runs backwards

Step 1. Polarity reversed to armature. Possible causes include:

- **A.** Wired backwards
- **B.** Brush plate in upside down
  - **B-1.** On 4" motors the red brush lead is on the bottom; opposite on smaller motors.
  - **B-2.** On 4" Terrova motors, the red brush is on the right side when viewing the brush plate from opposite the prop side.
- **C.** Magnet shell upside down (on 3 ¼" or 3 5/8" motor assemblies the marking notch should be on the bottom towards the skeg)

Case VII. Motor is noisy

Step 1. Possible causes:

- **A.** Water in lower unit
- **B.** Broken brush plate
- **C.** Grease or replace spherical or flange bearing
- **D.** Chipped/broken brushes (new brushes may take a few hours of operation to "seat" or round to the commutator and quiet down)
- **E.** Ensure rear seal shield (3 ¼" and 3 5/8" motors only) is securely in place and not "squealing" or rubbing against armature shaft
- **F.** Chipped/broken magnets – a rule of thumb is if the magnet that chips out is less than 1 square inch, the magnet shell is still functional.
- **G.** On 4" motors (bung on magnet center section), pull up lightly on brush wires to ensure all slack is out of lower area (so armature does not rub on the slack from the brush leads)
- **H.** Rough/worn commutator (where brushes ride) on armature. Smooth with fine sandpaper or emery cloth. If scratched too deeply, replace armature.
- **I.** Ensure the E-ring is securely snapped into place behind commutator. (Engine Mount models utilize a bushing instead of the E-ring.)
- **J.** The motors are "timed". Before you open a lower unit it is a good idea to use a grease pencil or put a piece of tape across the joints of the lower unit (front endbell to center housing and center housingl to rear endbell). Cut the tape with razor blade. Use these marks to assemble the lower unit exactly as it was prior to disassembly.
- **K.** When re-assembling a motor assembly ensure you evenly tighten the thru-bolts. (Tighten one a little, then the other, etc... Torque specs listed on **page 1-3**.)

Case VIII. Weedless Wedge 2 motor seems noisy

Step 1. The malfunction listed above is most likely due to rough handling and concealed damage that may have occurred while the motor was in shipment to the distributor/dealer.

- **A.** Dis-assemble the motor lower unit to remove and inspect the armature thrust/support bearing (small, sealed, caged ball bearing on end of the armature shaft).
- **B.** To test for bearing smoothness/roughness grasp the outer race of the bearing and lift the armature up so that it hangs straight down below the hand grasping the bearing race and supporting the armature. With your free hand, give the armature a spin. The armature should spin freely with no feel of roughness or "catching" of the bearing.
  - **B-1.** If any roughness or catching is noted inspect the armature. Examine the commutator sections for discoloration and arcing caused by the brushes as they make contact with "good/live" commutator sections and "bad/dead" sections. Replace armature if arcing is noted.
  - **B-2.** Test armature commutator sections for continuity from one section to the next going around the circumference of the commutator. Replace armature if no continuity is found.
  - **B-3.** Examine commutator section "tangs" that connect armature windings to each commutator section. Each "tang" should be pressed down flush to the brush surface of the commutator section. If any space is noted between the "tang" and the commutator "face" the potential for an intermittent electrical connection exists and the armature needs to be replaced.
- **C.** If the armature tested fine in **Steps B-1** through **B-3**, then just replace the armature bearing only. A bearing puller should be used to remove the rough bearing from the armature when installing new bearing, p/n 140-010. Press or drive on inner race only when seating new bearing on shaft.

Case IX. Motor vibrating excessively

Step 1. Possible causes include:

- **A.** Prop pin bent
- **B.** Prop – damaged or out-of-balance. Due to variables in materials, leading edge differences, and tolerance variations, some vibrations can be attributed to the prop. An easy fix is to:
  - **B-1.** Disconnect leads from the battery.
  - **B-2.** Remove the prop nut, keeping the prop pin horizontal.
  - **B-3.** Remove the prop.
  - **B-4.** Rotate the prop 180 degrees from the original position.
  - **B-5.** Re-install the prop and prop nut.
  - **B-6.** Re-test motor in water test tank. If vibration is not cured, replace with new propeller and re-test. If excessive vibration is still present, proceed to **Step 1B**.
- **C.** Armature – bent shaft or out-of-balance armature stack.
  - **C-1.** Remove the prop from the armature shaft.
  - **C-2.** Run the motor (never operate the motor for extended periods of time while out of water) on medium-to-high speed and watch the armature shaft for a "wobble" that may indicate a bent shaft. If wobble is noted, replace armature. You may also put your finger on the armature shaft to feel for a wobble, or briefly touch the shaft with a sharp pointed marker while it is spinning. A solid mark around the armature indicates a fairly straight shaft, while an inconsistent line may represent a bent armature shaft.

Case X. Customer complains the trolling motor is draining battery / batteries down too fast

Motors with a control board draw a small amount of amps whenever they are hooked to a power supply. (The relays are engaged.) Although this is a small amount, it will drain batteries down over time if the motor is left plugged in. We recommend unplugging the motor when not in use.

Step 1. Perform amp draw test while motor is under load in a water test tank (amp specs are listed in the annual Minn Kota product brochures and on the top of the parts lists on the Service CD).

- **A.** If amp draw meets or is less than stated specs, the motor is not the cause of the problem.
- **B.** If amp draw is higher than stated specifications:
  - **B-1.** Spin the prop by hand and feel for broken magnets.
  - **B-2.** Check for proper/even torque of thru bolts.
  - **B-3.** Check for shorted armature (commutator to armature shaft should not show continuity).
  - **B-4.** The center section with magnets could be partially demagnetized causing high amp draw.

Case XI. Motor show signs of corrosion / electrolysis

Step 1. Ensure that this issue is not due to saltwater corrosion on a non-RipTide motor.

- **A.** It is a good idea to add the sacrificial anode to all motors that are used in saltwater. The anodes would replace the prop nut on the older units: p/n 2198400 for 3 ¼" and 3 5/8" motors and p/n 2198401 for 4" lower units.

Step 2. If the motor is a 36-volt model, is the crank battery being used as one of the three trolling motor batteries?

- **A.** If no, go to **Step 3**.
- **B.** If yes, ensure the crank battery is the first battery in the trolling motor battery system. (The negative lead of the trolling motor should be connected to the crank battery.)

Step 3. If the motor is a later model Universal Sonar 1 (or a US1 motor that has had an internal ground / bonding wire installed from the brush plate mounting screw to the directional indicator light circuit) ensure the ground is connected to the negative (-) side of the indicator light.

- **A.** If you are not sure which wire is the negative (-) side, power up the motor and turn it on (the light is designed to have voltage applied to it when the propeller is spinning). With your VOM (multi-meter) set to check for VDC, touch the probes to either wire on both sides of the indictor light. If you have a +12VDC reading, the negative side is the one that your black probe is touching.

Step 4. The brush shunt wire may be inadvertently touching the inside of the motor case. This is more apt to happen on 4" motor assemblies after the lower unit has been opened during field repairs.

Step 5. Check for shorted armature (commutator to armature shaft should not show continuity).

Chapter 2.
Depth Finder Interference

Variable speed motors with a PWM speed control / Maximizer circuit can sometimes interfere with the operation of a depth finder. This can be due to RF (radio Frequency) or electrical interference.

***NOTE**: this procedure is for pre-Universal Sonar 2 units only.*
For more information regarding Universal Sonar, see Chapter 3.

Here are a few steps to reduce or eliminate the interference problem:

If the motor interferes with the depth finder when both are being operated:

Step 1. Determine if supply voltage for trolling motor and depth finder is provided by the same / common battery.
- **A.** If yes, disconnect depth finder battery leads from the trolling motor battery and connect them to the engine cranking battery.
- **B.** Test depth finder for interference while operating motor.

Step 2. Inspect for water in the lower unit.

NOTE: Steps 3-5 DO NOT apply to Universal Sonar 2 units!

Step 3. If interference is still present at Step 1B, proceed as follows:
- **A.** Connect a light gauge wire (18 gauge is fine) from the negative post of the trolling motor battery to the negative post of the engine's cranking battery. We suggest installing a 1 or 2 amp inline fuse in this ground wire. (Minn Kota P/N 2060310 is the fused grounding wire.)
- **B.** Test for depth finder interference while operating the motor.

Step 4. If interference is still present after installing the ground wire, proceed as follows:
- **A.** Check the routing of the depth finder and trolling motor battery leads. If they run parallel to each other for any length of distance, separate the leads as much as possible or run the leads to the trolling motor and depth finder on opposite sides of the boat.
- **B.** Test depth finder for interference while operating the motor.

Step 5. The brush shunt wire may be inadvertently touching the inside of the motor case. This is more apt to happen on 4" motor assemblies, after the lower unit has been opened during field repairs.

Step 6. If interference persists after completing the previous steps, proceed as follows:
- **A.** Check mounting location of the depth finder transducer. If the transducer is mounted externally on the trolling motor's lower unit, try temporarily moving it way from the lower unit while operating the motor and observing the depth finder display.
- **B.** If the interference is reduced or eliminated when the transducer is moved away from the motor's lower unit, the problem is due to the transducers proximity to the lower unit.
- **C.** To reduce / eliminate this type of RF interference, a ground wire can be connected to the trolling motor lower unit. This can be accomplished by means of either an external or internal connection. Grounding the motor case in this manner creates a "shield" between the motor brushes and the transducer, trapping / shunting the RFI to the ground.

  - **C-1.** To ground the motor case externally, drill a small diameter hole (1/8"), in the motor skeg. Attach one end of the ground wire at this point by using a self tapping stainless steel screw (18 gauge wire may be used for this purpose). Run the ground wire up the motor shaft along with the transducer coax cable. Connect the other end of the ground wire to the motor negative battery lead or post.

C-2. To ground the motor case internally it will be necessary to disassemble, reseal, and reassemble the motor lower unit. (We recommend this be done only by a Minn Kota authorized repair center with Minn Kota p/n 2880310.) With the lower unit disassembled, connect one end of a light gauge wire to the motor brush plate mounting screw (18 gauge wire may be used for this purpose). Run the ground wire up the fiberglass motor shaft along with the red and black motor brush leads. Connect the other end of the ground wire to the motor negative battery lead or post. Reassemble and reseal the motor lower unit. (On AutoPilot motors this can go to the brown coil cord wire, on Maxxum motors you can connect to the negative side of the directional indicator light. To determine which wire is the negative side: disconnect both the small gauge black and black w/orange stripe wires from the directional indicator light. Using a digital V.O.M. set to test continuity, touch one V.O.M. lead to the trolling motor negative battery lead wire. Touch the other V.O.M. lead (one wire at a time) to the black and the black w/orange striped wires in the control box. The wire showing continuity, with no resistance, is the negative wire. This is the wire that has continuity to the negative battery lead.)

By following these steps the problem of depth finder interference is usually resolved. Oftentimes, simply connecting the depth finder to a separate battery will address this issue. At other times, a separate battery and common negative ground is all that is required. For other installations, all of the steps outlined will be required. Keep in mind that the steps should be followed in the order they are written and that the final steps should be attempted only after completing steps 1-5 and testing with the depth finder.

Chapter 3.
Minn Kota Universal Sonar

Minn Kota Universal Sonar motors are serviced in the same manner as their non-Universal Sonar counterparts. Consult the appropriate section of the Minn Kota Service Manual for the step-by-step trouble shooting and repair procedures applicable to the motor being serviced. **This trouble-shooting section DOES NOT take the place of the specific sonar unit's trouble-shooting guide. Consumers should consult their owner's manual for their sonar unit for all depth finder problems.**

US1 transducers have a 14° cone and operate at 190-200 kHz.
US2 features temperature sensing and dual beam technology. They have a 20° cone at 200 kHz and a 60° cone at 83 kHz.

Please note that the transducer is held into the Minn Kota lower unit with tamper-resistant, torx-head screws (T-15). These are torqued to 12-15 inch/pounds. ***The Minn Kota factory warranty will be voided if the consumer tampers with these screws!***

Case I. Sonar display blacks out, loses bottom reading, or gives erroneous readings while trolling motor is running (operates fine with trolling motor off).

This is an indication of interference, not a faulty transducer!

Step 1. Consumer should refer to the user's manual for the sonar display configuration options. (Many sonar displays have noise reduction options within their menus.)

Step 2. Reduce gain of sonar display until an adequate display is visible.

Step 3. If this is a US2 model, check to make sure the internal fuse (in the control box) has not blown. The first year of US2 (AH serial numbers) did not have this fuse. See **Case V** of this chapter for an explanation as to why this fuse has blown.

Step 4. Determine if supply voltage for trolling motor and depth finder is provided by the same / common battery.
- **A.** If yes, disconnect depth finder battery leads from the trolling motor battery and connect them to the engine cranking battery.
- **B.** Test depth finder for interference while operating motor.

Step 5. If interference is still present, proceed as follows:
- **A.** Check the routing of the depth finder and trolling motor battery leads. If they run parallel to each other for any length of distance, separate the leads as much as possible or run the leads to the trolling motor and depth finder on opposite sides of the boat.
- **B.** Test depth finder for interference while operating the motor.

Step 6. Check the lower unit:
- **A.** Inspect for water in the lower unit.
- **B.** The brush shunt wire may be inadvertently touching the inside of the motor case. This is more apt to happen on 4" motor assemblies, after the lower unit has been opened for repairs.

NOTE: *Step 7 DOES NOT apply to Universal Sonar 2 units!*

Step 7. If interference is still present at **Step 4B**, proceed as follows:
- **A.** Connect a light gauge wire (18 gauge is fine) from the negative post of the trolling motor battery to the negative post of the engine's cranking battery. We suggest installing a 1 or 2 amp inline fuse in this ground wire. (Minn Kota P/N 2060310). This wire may cause additional interference on US2 models.
- **B.** Test for depth finder interference while operating the motor.

Case II. Sonar unit losing bottom reading after a certain depth reading.

Step 1. Customer should test with the trolling motor not running (prop off) at the depth where the problem is occurring.

- **A.** If the sonar bottom reading is correct with the trolling motor off, this is interference. See **Case I**, above for ideas on addressing this interference issue.
- **B.** If the sonar still has a problem losing the bottom reading even with the trolling motor off, suspect faulty transducer. Replace endbell / transducer assembly, as needed.

Case III. Sonar unit not receiving bottom reading with trolling motor ON or OFF.

(Be sure sonar unit is on current list of models compatible with Universal Sonar) see page 3-4 & 3-5

Step 1. Customer should first refer to the sonar unit's owner's manual for its specific trouble-shooting guide.

- **A.** Test the sonar with the original transducer that came with the sonar unit to determine if the sonar unit is faulty or if the Universal transducer is at fault.
  - **A-1.** If sonar works properly with original transducer; proceed to **Step 2**.
  - **A-2.** If sonar still does not receive bottom reading, problem lies in sonar unit.

Step 2. Using your VOM, perform a continuity check on the adapter cable. (This is the short cable that goes from the sonar unit to the extension cable plug end.)

- **A.** If the adapter has continuity through all pins, go to **Step 3.**
- **B.** If the adapter does not have continuity, adapter is defective. Replace adapter.

Step 3. Using your VOM, perform a continuity test through the extension cable.

- **A.** If there is continuity through all pins on the extension cable, go to **Step 4**.
- **B.** If there is not continuity through all the wires, the extension cable is defective.

Step 4. Replace the front-end bell / transducer assembly on the motor.
NOTE: on 4" diameter motors the transducer cable is held in place in the center section with a metal clip between the magnets. For ease of disassembly and reassembly, we recommend that the motor be removed from the shaft. On 3 5/8" diameter motors you will need to replace the shaft of the motor, also.

Case IV. US2 temperature readings are incorrect.

Step 1. Verify the sonar unit is on the current US2 compatibility list.

Step 2. Verify the correct adapter cable is being used.

Step 3. Verify all the plug connections are tight (in the control box and at the adapter cable).

Step 4. To check the temperature sensors:

- **A.** See **figure 1** below. Measure the resistance from the thermistor pins to the transducer cable connector (shield) one at a time. (Pin 2 to shield 5 and then Pin 4 to shield 5.)
  - **A-1.** The shield wire is used as an active ground for the thermistor signals so verify the metallic connectors on the US2 cables are tight.

NOTE: For troubleshooting the transducer cable, it may be easier to sacrifice a cable to make a "pigtail" rather than try to hold your VOM probes on the tiny pins. Take either an extension cable (female end) or any US2 adapter cable and cut the cable approximately 5 inches from the cable end. Strip the 4 conductors. You now have access to the following colored wires: red – pin 1 (transducer +), black – pin 3 (transducer -), yellow – pin 2 (thermistor +), brown – pin 4 (thermistor -) and shield.

- **B.** The resistance at normal room temperature (approximately 70° F) should be between 9K-11K ohms for each of the two temp pins. (The reading will vary slightly as the ambient room temp varies.) The transducer is defective and needs to be replaced if the readings do not fall within this range at normal room temperature.

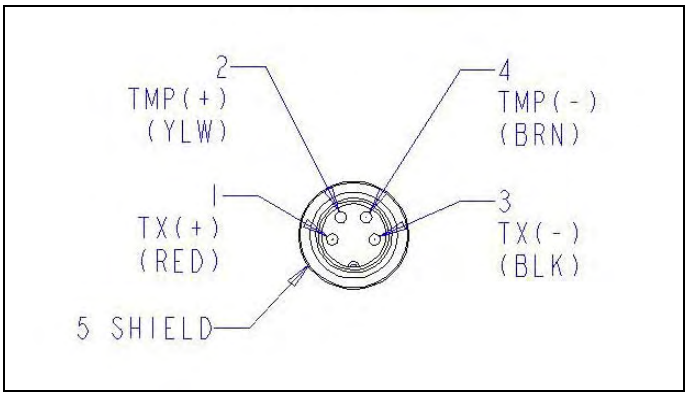


figure 1

Case V. US2 connector (adapter plug) getting hot.

US2 motors have internal bonding/grounding wire connections to eliminate depth finder interference. This internal bonding/grounding wire links the trolling motor negative to depth finder battery negative (starting battery negative). The combination of US2 motor internal bonding and the external ground connections could cause a shorted condition. This could result in damage to the motor that would not be covered by Minn Kota's warranty.

We have received a few calls regarding the metal US2 connector (adapter plug) getting hot. You can trace this to one of the following situations:

1. Depthfinder hooked to trolling motor battery. (The depthfinder needs to be powered by the crank/starting battery.)

2. The use of a DC alternator charger. (Some of these chargers link the trolling motor battery negative post to the starting battery while operating the outboard motor).

3. The use of one of the trolling motor batteries (on 24-volt or 36-volt motors) to provide power to start a "kicker" outboard motor.

4. The use of a "Perko™" switch to connect one of the trolling motor batteries (24/36v models) to the starting battery.

5. The brush shunt wire may be inadvertently touching the inside of the motor case. This is more apt to happen on 4" motor assemblies after the lower unit has been opened during field repairs.

NOTE: To address these issues caused by improper boat wiring, an internal fuse to the motor bonding/grounding wire was added late in the first year of production of the US2 (late AH serial numbers). If the fuse blows, the depth finder may be subject to interference issues. A blown fuse also indicates that one of the above conditions exists and **must** be corrected prior to replacing the fuse.

UNIVERSAL SONAR 1 COMPATIBILITY LIST

Plug It In. Find A Fish.

- Features an integrated and protected transducer
- No wires, ties or clamps
- Protects sensitive electronics from underwater hazards
- Universal Sonar is available on selected Maxxum Pro, Maxxum® and PowerDrive™ models

UNIVERSAL minn•kota SONAR

REQUIRED ACCESSORY ADAPTER FOR UNIVERSAL SONAR

ADAPTER #	SONAR BRAND	COMPATIBLE MODELS
MKR-US-1	Garmin	Fishfinder 100, Fishfinder 160, Fishfinder 240, Fishfinder 250,Fishfinder 250C, Fishfinder 320C, GPSMAP 168, GPSMAP 178C, Fishfinder 80*, Fishfinder 120* * with optional Garmin part number 010-10145-00, sold separately
MKR-US-2	Bottom Line	Tournament NCC 5300, Tournament NCC 6500
MKR-US-3	Bottom Line	Tournament 1250, Tournament 3310, Tournament 4300, Tournament 3100, Tournament 4100, Tournament 5100, Tournament NCC 6300, Tournament 320MAX, Tournament 480MAX
MKR-US-4	Humminbird	100SX, 405SX, LCRW, N525, Tracker Pro 160, Boater's World Pro Angler 400+, Legend 1000, Legend 2000
	Zercom	Z160
MKR-US-5	Eagle	FishEasy2P, FishMark 160, FishMark 240, TriFinder 2 FishEasy 2**, FishEasy2T**
	Lowrance	LCX-15MT, LCX-15CT, LCX-15CI, LCX-15C, LCX-16CI, LCX-16CT, LCX-18C, LCX-19C, LCX-104C, LMS-240, LMS-320, LMS-320DF, X-51, X-58DF, X-71, X-87, X-88DF, X-91, X-97, X-98DF, X-100C, X-105C DF, X-125, X-126 DF, X-135, X-136 DF, LMS-480, LMS-480 DF, LMS-330C, LMS-335C DF
MKR-US-6	Eagle	Accura 240, Accura 240FLW, FishEasy, FishEasy ST, Optima, Strata 128, Strata 128 Plus, Strataview 128, Trifinder, Trifinder FLW, UltraClassic, Ultra Classic Plus
	Lowrance	X24, X28, X29, X38, X48, X49, X58, X65, X75, X85
MKR-US-7	Vexilar	FL-8, FL-8 SE, FL-8 SLT, FL-10, FL-18, CLC-200
MKR-US-8	Humminbird	Legend 3000, 400TX, 300TX, Piranha 1, Piranha 2, Piranha 3, Piranha 4, Piranha 5, PiranhaMAX 10, PiranhaMAX 15, PiranhaMAX 20, Matrix 10, Matrix12, Matrix 15, Matrix 17, Matrix 20, Matrix 25, Matrix 27, Matrix 35, Matrix 37, Matrix 55, Matrix 65, Matrix 67, Matrix 67 Combo, Matrix 77c, Matrix 87c Combo, Matrix 97, Matrix 97 Combo, Fishfinder 515, Fishfinder 525, Fishfinder 535,Fishfinder 535 Portable, Fishfinder 565, Fishfinder 585c, Fishfinder 595c, 931c, 931c DF, 937c, 937c DF
MKR-US-9	Eagle	Cuda 168EX, Cuda 168, Cuda 128, Cuda 240GPS, FishElite 320, FishElite 480, FishMark 320, FishMark 480, SeaFinder 320DF, SeaFinder 240DF, SeaCharter 480DF, FishEasy 2*, FishEasy 2T*
	Lowrance	X-47, X-47EX, X-67C, M-56, M-68C
MKR-US-11		14 ½' Universal Sonar extension cable for use with all accessory adapters

**Manufactured before 2003 *Manufactured after 2002

Compatible with most major brands of fish-finding equipment (requires Accessory Adapter)

HUMMINBIRD Zercom MARINE BOTTOM LINE vexilar LOWRANCE GARMIN EAGLE

rev. 2/4/05

For the most current list of sonar units, please visit our web site at www.minnkotamotors.com or call Minn Kota Technical Services at (800) 227-6433.

UNIVERSAL SONAR 2 COMPATIBILITY LIST

MINN KOTA **2007 Universal Sonar 2 Compatibility Chart**

US|2

Choose the Universal Sonar 2 adapter plug that matches your fishfinder. Allows you to quickly and conveniently connect and disconnect motor from fishfinder. New shielded cable connections virtually eliminate the possibility of sonar interference and are waterproof for extra dependability.

Universal Sonar 2's state-of-the-art, integrated and protected transducer is built into the lower unit of the motor and all wiring runs inside the indestructible composite shaft - out of sight and out of harm's way. No clamps. No ties. No exposed wires or connections. You get optimal sonar performance to help you find fish.

The integrated transducer, concealed wiring and plug-in compatibility with a variety of fishfinders made the original Universal Sonar a "home run" of an idea. So naturally, we've made it even better. Universal Sonar 2 features new temperature sensing - compatible with all major fishfinder brands - and the performance of dual beam technology (available with all Humminbird® DualBeamPLUS™ models and select Lowrance® and Garmin® models). An expanded view and greater bottom detail gives you a totally new perspective of the water below.

Required Accessory Adapter for Universal Sonar 2

Adapter #	Sonar Brand	Compatible Models
MKR-US2-1	Garmin	Fishfinder 100, Fishfinder 160, Fishfinder 240, Fishfinder 250, Fishfinder 250C, Fishfinder 320C, GPSMAP 168, GPSMAP 178C, GPSMAP 188, GPSMAP 198C, Fishfinder 80‡, Fishfinder 120‡ ‡ with optional Garmin part number 010-10145-00, sold separately
MKR-US2-4	Humminbird	100SX, NS25, LCR W, 405SX, Legend 1000, Legend 2000, Tracker Pro 160, Boater's World Pro Angler 400+
	Zercom	Z160
MKR-US2-7	Vexilar	FL-8, FL-8 SE, FL-8 SLT, FL-10, FL-18, CLC-200
MKR-US2-8	Humminbird	Piranha 4, Piranha 5, PiranhaMAX 10, PiranhaMAX 15, PiranhaMAX 20, PiranhaMAX 30 PT, PiranhaMAX 210, PiranhaMAX 215, PiranhaMAX 220, PiranhaMAX 240, Matrix 10, Matrix 12, Matrix 15, Matrix 17, Matrix 20, Matrix 25, Matrix 27, Matrix 35, Matrix 37, Matrix 55, Matrix 65, Matrix 67 Combo, Matrix 77c, Matrix 87c Combo, Matrix 97 Combo, Fishfinder 515, Fishfinder 525, Fishfinder 535, Fishfinder 565, Fishfinder 575, Fishfinder 580 Combo, Fishfinder 585c, Fishfinder 595c, 141c, 161, 323, 343c, 363 Combo, 383c Combo, 717, 727, 737, 747c, 757c Combo, 767 Combo, 777c2, 787c2 Combo, 787c2i Combo, 917c Combo, 931c, 937c Combo, 957c Combo
MKR-US2-9	Eagle	Cuda 168, Cuda 168EX, Cuda 128, Cuda 240 S/GPS, Cuda 240i S/GPS, Cuda 242, Cuda 250, FishElite 320, FishElite 480, FishElite 500C, FishElite 520C, FishElite 640C, FishElite 642C, FishMark 320, FishMark 480, FishMark 500C, FishMark 640C, SeaFinder 240DF, SeaFinder 245DS, SeaFinder 250DF, SeaFinder 320DF, SeaFinder 480DF, SeaFinder 500CDF, SeaFinder 640C, SeaFinder 642C, SeaCharter 320DF, SeaCharter 480DF, SeaCharter 500CDF, FishEasy 2*, FishEasy 245DS, FishEasy 250DS, FishEasy 320C
	Lowrance	X-47, X-47EX, X-50DS, X-67C, X-86DS, X-96, M-52i, M-56, M-56i, M-68C, M-68i
MKR-US2-10	Lowrance	LCX-20C, LCX-17M, LCX-25C, LCX-26C, LCX-27C, LCX-28C, LCX-37C, LCX-38C, LCX-110C, LCX-111C, LCX-112C, LCX-113C, LMS-330C, LMS-332C, LMS-334C, LMS-335C DF, LMS-337, LMS-339C, LMS-489, LMS-480 DF, LMS-520C, LMS-522C, LMS-525C, LMS-527C, X-52, X-59 DF, X-100C, X-102C, X-105C DF, X-107C DF, X-125, X-126 DF, X-135, X-136 DF, X-510C, X-515C
MKR-US2-11		14 1/2' Universal Sonar 2 extension cable for use with all accessory adapters

*Manufactured after 2002

HUMMINBIRD. EAGLE GARMIN. LOWRANCE vexilar Zercom MARINE

US|2

Look for this sign.
Universal Sonar 2 is available on select Maxxum Pro, Maxxum Bow Mount, Terrova and PowerDrive V2 trolling motors. Look for the Universal Sonar 2 logo on the motor of your choice.

3 20 07 7550107

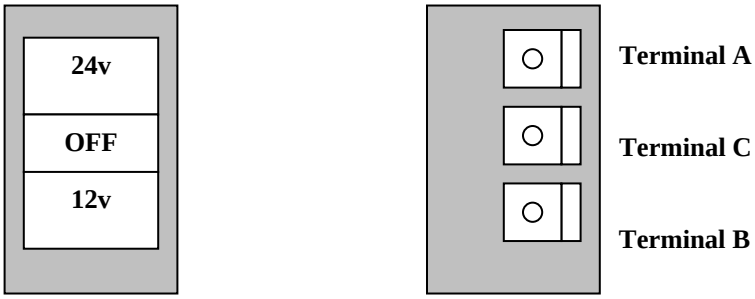
Chapter 4.
Hand-Control Models with a Speed Coil

Case I. Motor fails to operate (on any speed).

Step 1. Check to ensure proper voltage. Inspect all battery connection, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Check to see if lower unit runs.
- **A.** Connect battery lead wire to battery.
- **B.** Disconnect the black battery leadwire from the switch and connect it directly to the black brush lead.
- **C.** Disconnect the red battery leadwire from the switch and touch it directly to the red brush lead.
  - **C-1.** If motor does run, proceed to **Step 3**.
  - **C-2.** If motor does not run, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water damage, brushes not making proper contact, or an open or shorted armature. Repair as needed and test motor for proper operation.

Step 3. If unit being serviced is not a 12/24-volt model, proceed to **Step 4**. If unit being serviced is a 12/24-volt model, check 12/24 switch for continuity.



(front side of switch) **(back side of switch)**

- **A.** Turn the 12/24 switch to 12-volt ON position. Check for continuity between the common "**C**" terminal and the "**A**" terminal.
  - **A-1.** If no continuity is noted, replace the 12/24 switch and test motor for proper operation.
  - **A-2.** If continuity is observed, proceed to **Step 3B**.
- **B.** Turn switch to 24-volt ON. Check for continuity between the common terminal **(C)** and terminal **(B)**.
  - **B-1.** If no continuity is observed, replace 12/24 switch and test motor for proper operation.
  - **B-2.** If continuity is observed, proceed to **Step 4**.

Step. 4 Speed switch is defective. Replace the speed switch. Test motor for proper operation.

Case II. Motor operates on some speeds, not on others.

Step 1. Check to see if all wires are securely attached to the proper switch terminals.

Step 2. Check speed coil functionality.
- **A.** Connect battery lead wire to battery.
- **B.** Disconnect the black battery lead from the switch and connect it directly to the black brush lead.
- **C.** Disconnect the red battery lead from the switch and touch it to each colored speed coil wire at the switch terminals, one at a time. The motor should run as you make each connection.
- **D.** If the motor fails to run as you touch any of the colored speed coil wires, the problem is either: (1) the speed coil is faulty and needs to be replaced; or (2) the speed coil jumper wire is not connected to the back of the brush plate (in the lower unit).
  - **D-1.** If the motor runs as you touch the red battery lead to some of the colored speed coil wires, but not all the speed coil wires, the speed coil is faulty and needs to be replaced.
  - **D-2.** If the motor runs as you touch the red battery lead to each speed coil wire, proceed to **Step 3**.

Step 3. Speed switch is defective. Replace Speed switch. Test motor for proper operation.

Case III. Motor works at all speed settings, but the customer is complaining that there is no variation between speeds.

Step 1. Perform an amp draw check while the motor is running in a water test tank.

- **A.** If the amps step up as the speed setting increases, the motor is performing as designed.
- **B.** If the amp draw does not increase along with the speed settings check the amp draw of each speed directly through the speed coil:
  - **B-1.** Remove the control box cover. Disconnect wires at the switch from the wires to the lower unit.
  - **B-2.** With the lower unit still in a water test tank, connect -12 volts to the black motor/brush lead.
  - **B-3.** Connect +12 volts to each colored speed coil wire coming up through the motor tube from the lower unit. The motor will run (on the separate speed designations) as you make each connection. Note the amp draw as you test the different colored wires.
    - **a.** If the amp draw does not vary as you make the different connections (with the lower unit still in a water test tank) replace the front end bell/potted speed coil assembly.
    - **b.** If the amp draw does vary as you make the different connections, replace the 5-speed switch.

Chapter 5.
Hand-Control Models with a Printed Circuit Board
(This does not pertain to 3X models. The 3X information is in chapter 6.)

Case I. Motor runs intermittently (cuts in and out, fails to run in either forward or reverse, or kicks from forward into reverse).

Step 1. Check to ensure proper voltage and polarity at battery (red +, black -). Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Check to see if lower unit runs properly.
- **A.** Connect battery lead wire to battery.
- **B.** Disconnect the black battery lead from the control board and connect it directly to the black brush lead.
- **C.** Disconnect the red battery lead from the control board and touch it directly to the red brush lead. The motor should run.
  - **C-1.** If motor does not run, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature.
  - **C-2.** If the motor does run, replace control board.

Case II. Motor fails to operate.

Step 1. Check to ensure proper voltage and polarity at battery (red +, black -). Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Check to see if all wires are securely attached to the proper control board terminals. Check for corroded connections.

Step 3. Check to see if lower unit operates.
- **A.** Connect battery lead wire to battery.
- **B.** Disconnect the black battery lead from the control board and connect it directly to the black brush lead.
- **C.** Disconnect the red battery lead from the control board and touch it directly to the red brush lead. The motor should run.
  - **C-1.** If motor does not run, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature.
  - **C-2.** If the motor does run, go to **Step 4**.

Step 4. Check control board.

MODELS WITH A SOFT-POT
- **A.** The soft-pot is no longer available. If the soft-pot is damaged or intermittent you will need to replace the control board.

MODELS WITH A MAGNETIC ON/OFF REED SWITCH
- **A.** After rechecking that all wires are securely attached to the proper connections with proper voltage, verify the control board is defective:
  - **A-1.** Check for control board output by hooking up a test light (or V.O.M. probes) to board output terminals (consult appropriate wiring diagram). Remove handle assembly (with handle pivot and magnet rod) off potentiometer. (The magnet rod needs to be away from the on/off reed switch.) Connect battery leads to proper voltage. Vary the potentiometer by turning potentiometer's stem. The test light should vary in intensity from off to bright. If there is no control board output, the main control board is defective.

Chapter 6.

3X Steering

For the one-time procedure to initially orient "straight ahead" on bowmount 3X models go to **page 6-10 for BowGuard 360°** models or **page 6-12 for units with latch & door brackets** .

Case I. Directional Indicator always stays lit.

This reed switch is usually open. With the handle bar magnet in close proximity to the reed switch, the reed switch contacts will close and disengage power to the PWM circuit. Removing the bar magnet from close proximity to the reed switch will open the switch contacts, energize the PWM circuit, and light the directional indicator.

Step 1. Check to ensure that the magnet is in place in the handle pivot assembly.

Step 2. Check to ensure that the sensor bracket and on/off reed switch are in the proper position.

Case II. Steering is squeaky.

Step 1. Replace the gear carrier (P/N 2072210) and gear carrier bearing (P/N 2077320). See disassembly / reassembly instructions below.

Disassembly / Reassembly Procedures

The complete disassembly / reassembly procedures listed here will aid the repair center when repairing any 3X Minn Kota motor. We suggest that this entire 3X repair section be read prior to starting a 3X repair procedure.

NOTE: The basic disassembly / reassembly procedures outlines in this section apply to both transom and bowmount, freshwater and saltwater (RipTide) 3X motors.

Fig. 1
Transom mount 3X

Fig. 2
Bow mount 3X

3X Disassembly

Step 1. Start by removing the extension handle from the inner handle by pressing down on the handle by pressing down on the handle latch / detent button located on the top side of the handle near the control box. With latch button depressed, slide the extension handle off and clear of the inner handle. **(see Fig. 3, page 6-2)**

Step 2. Remove the six Phillips, pan head screws (#6-20 x 5/8") located on the underside of the control box assembly. (2 screws at front, middle, and rear of control box) **(see Fig. 3, page 6-2)**

A. With the cover screws removed the control box cover can be lifted up and tipped to the side to access the battery meter wires. Disconnect the red and black battery meter leads from the speed selector (on 5-speed models) or the red and black wires exiting the control board on variable-speed 3X motors.

Step 3. Lift up the inner handle assembly along with the handle pivot, handle bearing, and potentiometer (variable-speed motors) or speed selector switch (5-speed motors). Disengage the inner handle assembly from the "D" shaft on the potentiometer/switch, remove the inner handle, and set it aside for reassembly. **(see Fig. 3)**

Step 4. At this point prior to further disassembly, note the routing and positioning of all electrical wiring. When reassembling the 3X motor the wires must be placed back in the same position to avoid getting the wires in the circular rack and pinion steering gear mechanism.

A. Disconnect the motor wires, battery leads, and directional indicator light leads from the speed selector switch (5-speed motors) or control board (variable-speed motors).

A-1. On 5-speed 3X models, the switch can easily be separated from the control box when the wires are disconnected.

A-2. On variable-speed 3X models, loosen the Phillips pan head screw (P/N 2073414, #6-32 x 3/8") holding the P/N 2071905 sensor bracket in place. (Sensor bracket is located in control box along side the potentiometer support.) Loosening the screw allows removal of the magnetic on/off reed switch attached to wires exiting the control box. (On/off reed switch is the small 5/8" long, 3/16" diameter black cylinder with 2 small black wires attached.) Then remove the two P/N 2073416, #8-32 x ½" socket head cap screws (located in recessed openings on the underside of the control box) using a 9/64" allen wrench/driver. The control board is then free to be removed. **(see Fig. 3)**

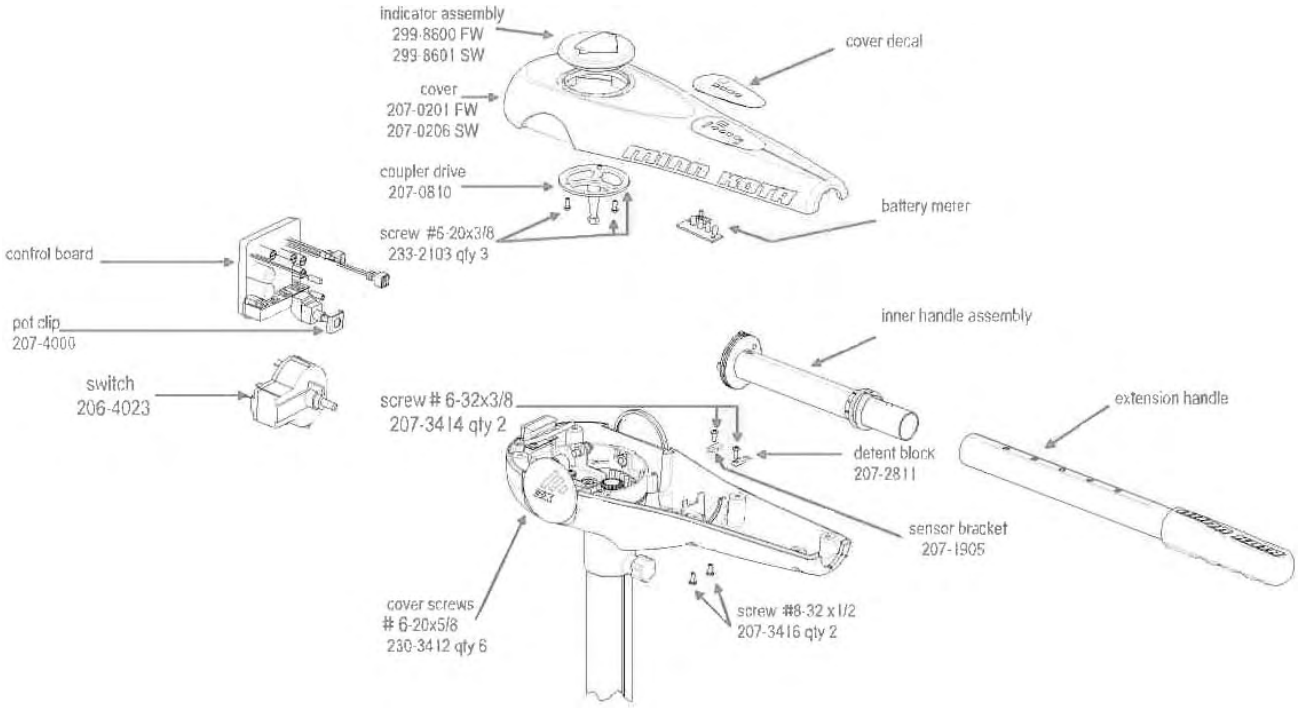


Fig. 3

Step 5. Once again, prior to further disassembly, note how the 3X motor wires are routed and held in position by the wire clamp located on the coupler socket retainer / indicator light bracket assembly P/N 2992900. **(see Fig. 4, page 6-3)** Also note how the directional indicator light wires are twisted and wire

tied to the motor wire to prevent the indicator light wires getting in the circular rack and pinion steering gear mechanism.

A. Remove the P/N 2372100 phillips head screw (#8-18 x 5/8") holding the retainer / light bracket / wire clamp assembly P/N 2992900 in place.

B. **IMPORTANT** – With the control box parallel to the motor lower unit, note how two sides of the hexagon ID of the coupler socket (P/N 2070800 black coupler socket for bow mount motors, P/N 2070801 white couple socket for transom mount motors) are parallel to / in-line with the control box pivot screws (P/N 2073408). When reassembling a 3X motor, the coupler socket (which drives the directional indicator) must be repositioned in this exact same manner for proper orientation of the directional indicator arrow. (Directional arrow is parallel to the motor lower unit pointing towards the direction of boat travel when in the water with the motor running.)

C. After removing the retainer / light assembly, remove the coupler socket, idler gear, idler plate, and preload ring (P/Ns 2070800/2070801, 2072215, 2071900, and 2073000). **(see Fig. 4)**

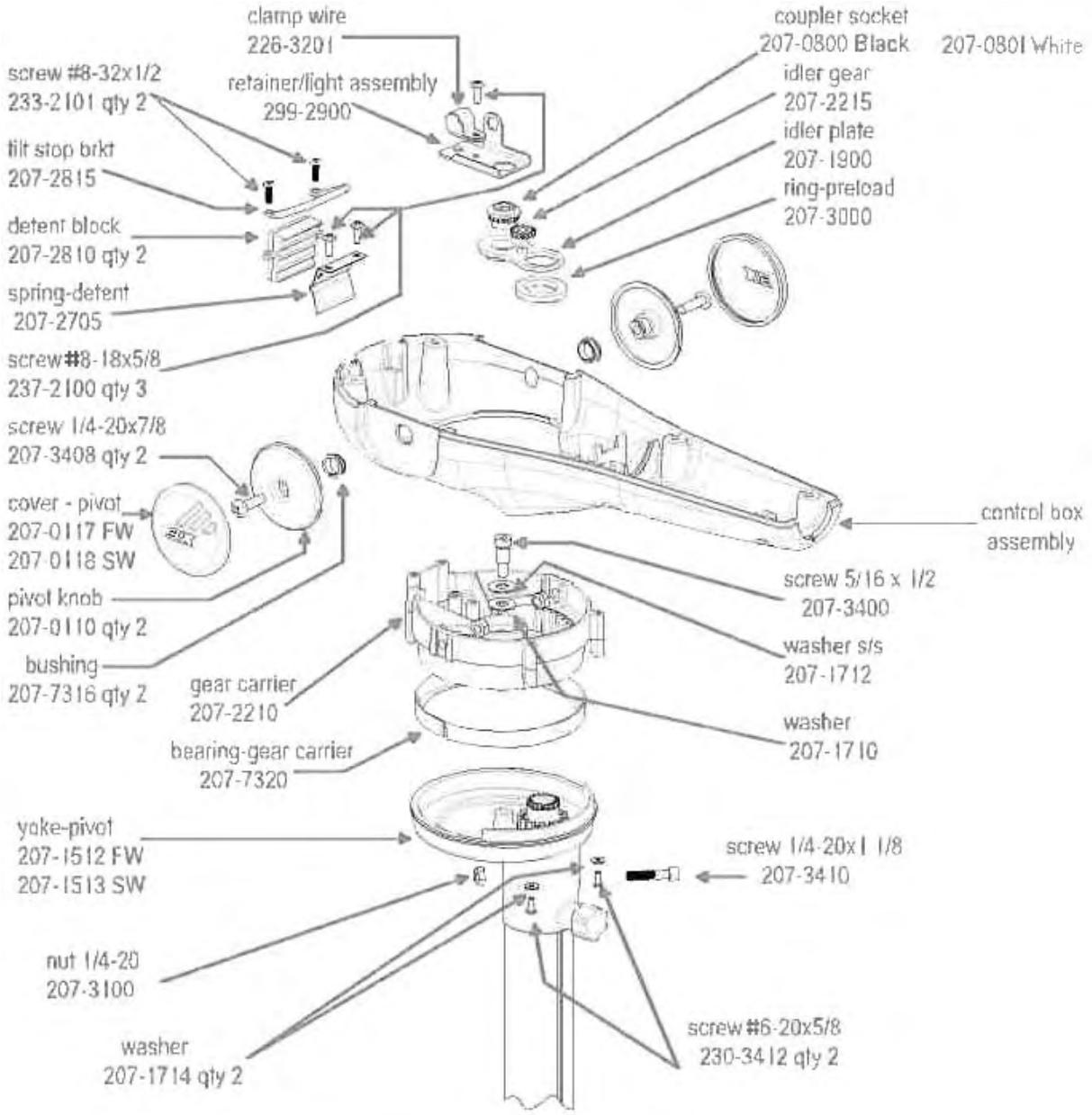


Fig. 4

Step 6. Remove the two P/N 2332101 #8-32 x ½" tilt stop bracket / detent block retaining screws, then remove -the P/N 2072815 bracket and P/N 2072810 detent block. **(see Fig. 4, page 6-3)**

Step 7. Remove the two soft plastic pivot knob covers (P/N 2070117 or 2070118) to expose the two ¼-20 x 7/8" Phillips head screws (P/N 2073408) that hold the pivot know and control box assembly on the gear carrier (P/N 2072210) / pivot yoke (P/N 2071512 or 2072513) assembly. **(see Fig. 4, page 6-3)**

A. Removing the two P/N 2073408 screws (these two screws go in to two nyloc nuts located inside the gear carrier) will allow the control box assembly, pivot knobs, and bushings to be separated from the gear carrier and yoke pivot assembly. **(see Fig. 4, page 6-3)**

Step 8. With the control box assembly removed, unscrew the 5/16" x ½" socket head, shoulder shank cap screw (P/N 2073400) that is located in the center of the gear carrier (P/N 2072210). (A 5-32" allen wrench / driver is required.) **(see Fig. 4, page 6-3)**

A. Remove the cap screw along with the washers, then remove the two P/N 2303412 #6-20 x 5/8" Phillips head screws and P/N 2071714 washers that serve to guide/retain the gear carrier on the pivot yoke. **(see Fig. 4, page 6-3)**

B. With the cap screw and 2 phillips head screws removed, the gear carrier can be removed from the pivot yoke followed by the gear carrier bearing. For reassembly, note that this bearing is split and that the split ends key onto a rib located on the inside circumference of the pivot yoke.

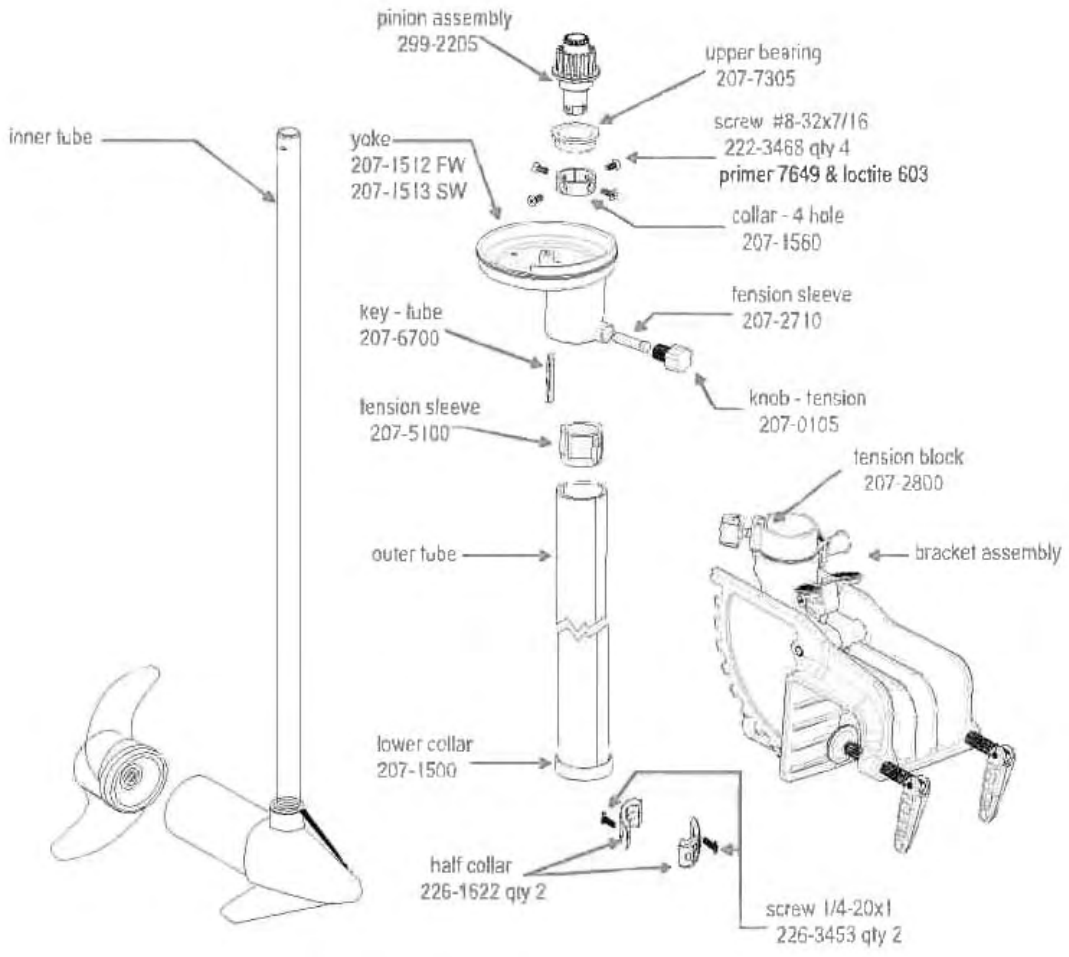


Fig. 5

Step 9. Remove the collar halves (P/N 2261622) clamped around the motor inner tube (1-1/8" diameter tube). The collar halves are located just below the lower collar (P/N 2071500) on the outer tube of either the transom mount or bowmount 3X motor. (A 3/16" allen wrench / driver is required.) **(see Fig. 5, page 6-4)**

Step 10. With the collar halves removed, the motor lower unit and inner tube assembly can be pushed / lifted up to expose the 4-hole collar (P/N 2071560) and four #8-32 x 7/16" Phillips flathead countersunk screws (P/N 2223468) that hold the pinion gear assembly into the inner tube. **(see Fig. 5, page 6-4)**

A. Remove the four screws (P/N 2223468) to allow removal of the pinion assembly (P/N 2992205), upper bearing (P/N 2077305) and 4-hole collar. **(see Fig. 5, page 6-4)**
NOTE: The four pinion assembly retaining screws are held in place with LocTiteTM during assembly. Removal may require heat application to the screw head. When reassembling a 3X motor, LocTiteTM primer and #603 compound MUST be reapplied to these four retaining screws.

B. With the four retaining screws removed the pinion assembly, upper bearing, and 4-hole collar can be removed.

Step 11. With the pinion assembly, bearing, and 4-hole collar removed, the motor lower unit / inner tube assembly along with the lower collar (P/N 2071500) can be slid down and out the bottom of the outer tube.

Step 12. To remove the pivot yoke from the upper end of the outer tube, loosen the ¼-20 socket head cap screw and nyloc nut that serves to clamp the pivot yoke on to the outer tube. Loosen the steering tension knob (P/N 2070105).

A. With the screw and nut loose the pivot yoke (P/N 2071512 or P/N 2071513) can be lifted up and off the outer tube. **NOTE:** When removing the pivot yoke, note its position / orientation on the outer tube.

A-1. On transom mount 3X motors, the steering tension knob is positioned towards the bracket clamp screws.

A-2. On bow mount 3X motors, the steering tension know is toward the boat when mounted and positioned for installation of the bow mount orientation collar.

A-3. Also, note that a tube key (P/N 2076700) is used to properly position the pivot yoke in relation to the slots / grooves in the outer tube.

Step 13. For further disassembly / replacement of the transom bracket or BowGuard 360º assembly, the outer tube (or outer tube and pivot yoke assembly) can be slid out of the transom bracket hinge or BowGuard 360º.

A. On transom mount 3X motors, note that a tension block (P/N 2072800) is located between the outer tube and the orientation collar on the transom bracket. This block will fall out of place when the outer tube is removed from the bracket hinge. Be sure to re-install this part when reassembling a 3X transom mount model.

This concludes the basic disassembly procedures for 3X transom and bow mount, fresh and saltwater motors. 3X motor lower unit trouble shooting, disassembly, and repair procedures are the same as all other Minn Kota 5-speed or variable speed motor units.

For re-assembly instructions go to page **6-6**.

3X Reassembly

Step 1. With the outer tube and pivot yoke properly positioned and slid into the transom bracket hinge or BowGuard 360º assembly (reference Disassembly Procedure **Step 12**), slide the motor lower unit, inner tube assembly, and lower collar (P/N 2071500) back into place in the outer tube with the upper end of the inner tube extending out the top of the pivot yoke. **(see Fig. 5 on page 6-4)**

Step 2. Re-install the 4-hole collar, upper bearing, and pinion assembly on / in the inner tube.

A. Prior to installing the pinion assembly, examine the upper / top end of the pinion gear teeth. Two of the gear teeth will have small raised bumps.

A-1. On transom mount 3X motors when looking straight down at the control box area and lower unit assembly, rotate the nose of the lower unit into the 12 o'clock position (prop in the 6 o'clock position). On the pinion assembly, the two teeth with the raised bumps need to be oriented towards approximately the 9 o'clock position.

A-2. On bow mount 3X motors the two teeth with the raised bumps need to be oriented toward the prop end of the motor lower unit when installed in the inner tube.

B. Examine the four pinion assembly retaining screws (P/N 2223468) for any damage. Replace them with new screws as needed.

B-1. Re-apply LocTite primer and LocTite #603 compound, then insert and tighten the screws securely into the 4-hole collar, inner tube, and pinion gear assembly.

Step 3. Place the outer tube / pivot yoke assembly and inner tube, upper bearing, and pinion gear assembly back into their normal assembled positions. (Normal assembled position is with the upper bearing supported in its recessed area of the pivot yoke.)

A. Slip the lower collar (P/N 2071500) up into place on the lower end of the outer tube.

A-1. Re-install the collar halves (P/N 2261622) on the inner tube using the two ¼-20 x 1" socket head cap screws.

A-2. Slide the collar halves up against the bottom of the lower collar and tighten the collar screws to secure the collar in place.

Step 4. Re-install the gear carrier bearing (P/N 2077320) in the pivot yoke.

A. Use care to line up the rib in the pivot yoke with the ends of the split gear carrier. **(see Fig. 5, page 6-4)**

Step 5. Transom mount motors -

A. Align the motor lower unit with the transom bracket. Position the lower unit with the "nose" of the motor towards the transom bracket clamp screws. Block or hold the motor lower unit in this position.

B. Place the gear carrier (P/N 27702210) into position in the pivot yoke with the tilt detent spring (P/N 2072705) towards the prop end of the motor lower unit.

C. While looking at the two pinion gear teeth with the raised bumps, count five teeth clockwise and you will see a raised rib / dash.

C-1. The tooth with the raised dash must line up with the timing mark in the gear carrier. **NOTE:** The timing mark used for transom mount 3X models is a small raised rib located at the 1:30 o'clock position on the inside circumference of the gear carrier. **(see Fig. 6, page 6-7)**

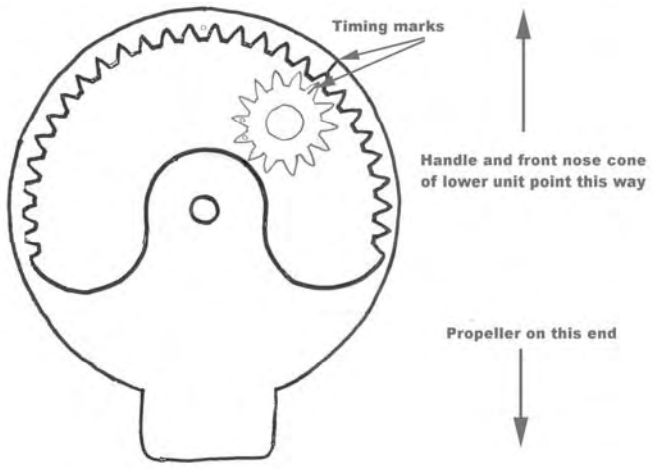


Fig. 6

Bow mount motors –

A. Align the motor lower unit with the prop end on the same side as the steering tension knob in the pivot yoke. Block or hold the motor lower unit in this position.

B. Place the gear carrier (P/N 27702210) into position in the pivot yoke with the tilt detent spring (P/N 2072705) towards the "nose" of the motor lower unit.

C. Align the two pinion gear teeth with the raised bumps (on bow mount 3X models these two teeth will be oriented toward the prop end of the motor lower unit) with the timing mark in the gear carrier.

NOTE: The timing mark used for bow mount 3X models is a raised bump on the gear tooth. (Located in the 12:00 o'clock position when the gear carrier is held with the detent spring towards the viewer and viewed from above.) **(see Fig. 7)**

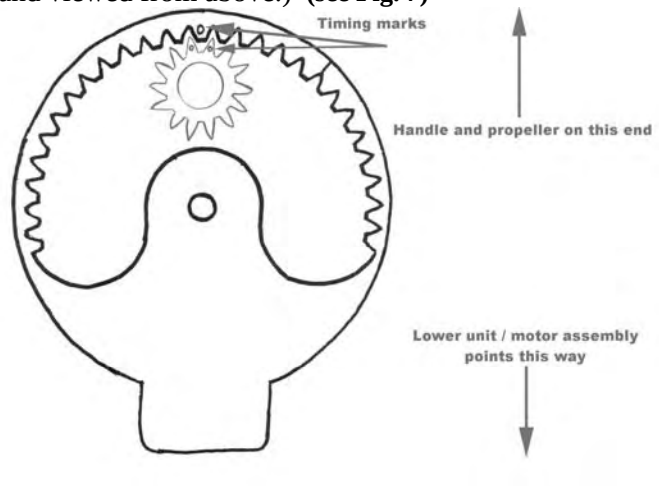


Fig. 7

Step 6. With the gear carrier in its proper location and position (relative to the appropriate timing marks), re-install the socket head cap screw (P/N 2073400) and washers. Blue LocTite is recommended on this screw. Tighten screw with a 5/32" allen wrench / driver.

A. Re-install the two #6–20 x 5/8" phillips head screws (P/N 2303412) and washers (P/N 2071714) that retain / guide the gear carrier on the pivot yoke.

Step 7. Re-install the control box with bushing and pivot knobs on to the gear carrier pivot yoke assembly. **(see Fig. 4, page 6-3)**

A. Position the control box so that the handle end of the box is opposite the tilt detent spring in the gear carrier.

B. Examine the pivot knobs in the area where they contact the gear carrier. Note the two flat surfaces on both edges of the pivot knob shank. These two flats must be aligned with the two ribs along side the hole in the gear carrier for the pivot knob screws (P/N2073408).

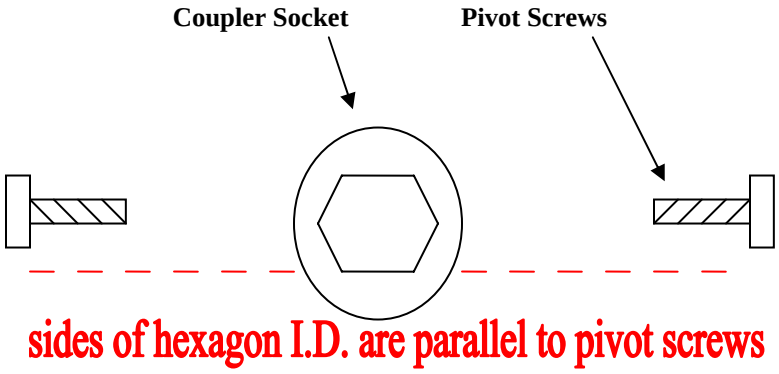
C. With the control box, bushing, pivot knobs, pivot knob screws, and nyloc nuts in their proper position, securely tighten the two ¼-20 x 7/8" phillips head pivot knob screws.

C-1. The two soft plastic pivot knob covers can be re-installed at this time. Note the flat surfaces on the outer edge of the pivot knob as they serve to "key" the pivot knob covers to prevent their rotation.

Step 8. Re-install the tilt detent block (P/N 2072810) in the control box (teeth towards the detent spring) followed by the tilt stop bracket (P/N 2072815) and the two #8-32 x ½" phillips head screws that are used to attach both parts to the control box.

Step 9. Re-install the preload ring (P/N 2073000), idler plate (P/N 2071900) idler gear (P//N 2072215), and coupler socket (P/N 2070800 or P/N 2070801). (White coupler socket for transom mount motors and black coupler socket for bow mount motors.)

A. As noted during disassembly, position the coupler socket so that any two parallel sides of the hexagon I.D. of the coupler socket are as close as possible to being parallel to the control box pivot screws.



Step 10. Re-install the control board or 5-speed switch using the fasteners or parts removed during disassembly. **(see Fig. 3, page 6-2)**

A. Reconnect motor wires, battery leads, directional indicator light wires, and (if a variable speed unit) place the on/off reed switch back in its proper location. Tighten the sensor bracket screw to secure reed switch.
NOTE: if connections were sealed with heat shrink tubing prior to disassembly they MUST be resealed with new heat shrink!

B. Re-install the inner handle assembly. Start by engaging the "D" hole in the handle pivot on the "D" shaft of the potentiometer or 5-speed switch. Then place the handle pivot, inner handle, and handle bearing in their proper location. (Note that the triangular shaped arrow on the handle bearing is on top.)

C. Reconnect the red and black battery meter leads to the appropriate wires (exiting the control board on variable speed motors or switch on 5-speed motors).
NOTE: the red and black battery meter wires must be routed to the side of the control box cover and pushed in to the slots in the cover ribs prior to installing the cover on the control box.

D. Also prior to cover re-installation, line up the directional indicator with the motor lower unit. (The directional arrow points toward the "nose of the motor lower unit.)

E. Position cover in place on control box and secure with the six #6-20 x 5/8" phillips head screws (P/N 2303412).

Step 11. Re-install extension handle and test the motor for proper full range 3X steering function to make sure that nothing is binding or restricting the steering system.

A. Connect the motor battery leads to the appropriate voltage and test run for speed variation and function. Test the battery meter for proper function. Test the control box tilt adjustment for proper range and travel. Check and verify overall motor operation and function.

This concludes the basic 3X motor re-assembly procedures. Further step-by-step repair procedures will be added as needed when field service issues arise

(This is a 1-time procedure to initially orient "straight ahead" on bowmount 3X models with BowGuard 360°.)

3X ALIGNMENT AND COLLAR INSTALLATION

1). Remove the depth collar from bag and review your type of mounting.

THE DEPTH COLLAR COMES SET FOR STANDARD CONFIGURATION OR OPTION #1

2). Set the depth collar aside until the motor is mounted and aligned.

3). **DEPLOY THE UNIT, MAKING SURE THE MOTOR IS SUPPORTED BELOW. THE MOTOR *WILL FALL* DOWN UNITL THE HANDLE HITS THE MOTOR MOUNT IF *NOT SUPPORTED* WHEN DEPLOYING.**

4). The motor will come un-aligned similar to the picture to the right.

5). Align handle parallel with the centerline of the boat. Hold the handle and rotate the outer shaft until the steering tension knob is aligned with the handle. See pictures below. (Handle and knob are aligned)

FOLLOW THE HANDLE ALIGNMENT FOR BOTH MOUNTING OPTIONS.

6). Raise the motor and place a support under the lower unit.

NOTE: At this point, the handle, tension knob, outer shaft keyway and lower unit should now be aligned. If not, repeat steps 2-5.

7). If mounting configuration or option #2 is preferred, the orientation block must be rotated 180°. The orientation block must be removed and rotated so the retaining key is on the right hand side of the screw. The picture below shows orientation block configuration or option #1.

8). Open the depth collar and align the pocket in the collar with the tab on the Bowguard unit.

9). Leaving the depth collar open, place it on the shaft as shown with tab engaged in pocket.

10). Loosen orientation block screw so key can freely slide. Push on the screw and slide the orientation block until key falls into the slot in shaft.

11). Once key is clearly in slot on shaft and collar half is fit into place, close and tighten depth collar.

12). Tighten orientation block screw.

End of procedure.

(This is a 1-time procedure to initially orient "straight ahead" on bowmount 3X models with latch & door mounts.)

3X ALIGNMENT AND RING INSTALLATION

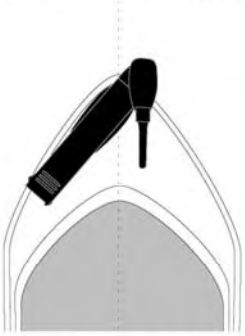
1). Review your type of mounting.

2). Deploy the motor.

3). The handle will come unaligned with steering tension knob, similar to photo.

NOTE: SUPPORT THE LOWER UNIT FOR THE FOLLOWING STEPS. LOOSENING THE DOOR CLAMP SCREW WILL ALLOW THE MOTOR TO FALL UNTIL THE HANDLE HITS THE MOTOR MOUNT IF NOT SUPPORTED.

4). Loosen the door clamp screw align handle parallel with the centerline of the boat. Hold the handle and rotate the outer shaft until the steering tension knob is aligned with the handle. See pictures below. (Handle and knob are aligned)

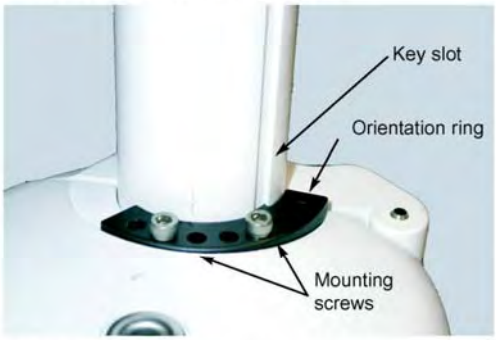


FOLLOW THE HANDLE ALIGNMENT FOR BOTH MOUNTING OPTIONS.

5). With the handle and steering tension knob aligned with the centerline of the boat, raise the unit similar to the photo below and retighten the door clamp screw in this position for orientation ring installation.

NOTE: At this point, the handle, tension knob, outer shaft keyway and lower unit should now be aligned. If not, repeat steps 2-5.

6). Place the orientation ring in the hinge base with the key in the keyslot of the outer shaft. Photo below shows mounting option 1.



NOTE: THE RING CAN BE TURNED OVER FOR MOUNTING OPTION 2.

7). Align two of the seven holes in the ring with two screw holes in the hinge base. Note: beacuse of the multiple hole options, it may be necessary to loosen the door and rotate the shaft slighlty either way to proplerly align the holes for the mounting screws.

8). Insert the two supplied socket head ss screws into the holes and tighten with the supplied hex wrench.

9). The motor can be removed without removing the orientation ring. To re-install the motor, line up the key with the key slot and close door.

End of procedure.

Chapter 7.

Vantage

Case I. Motor fails to operate (prop doesn't spin).

Step 1. Check to ensure proper voltage and polarity at battery (red +, black -). Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Remove extrusion shield (p/n 2050220) (**see figure 1, page 7-6**), check to ensure that all wires are connected to the proper control board terminals, (consult the appropriate Vantage wiring diagram for proper connections). Visually inspect the wire terminals and connections for corrosion. Clean, if needed.

Step 3. Check lower unit to see if it will run when all switches and circuit board are bypassed.

- **A.** Disconnect black and black/red stripe wires from main control board. Apply 12 volts directly to these two leads.
  - **A-1.** If the motor does not run, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as needed and test motor for proper operation.
  - **A-2.** If the motor does run, go to **Step 4**.

Step 4. Check ON/OFF switch and speed control potentiometer in the steering handle.

- **A.** Disconnect black and white coil cord wires located behind the extrusion shield (p/n 2050220). (NOTE: the coil cord wires are the small gauge wires with bullet connectors.)
- **B.** Connect the black and white wires coming from the handle assembly to your V.O.M..
- **C.** With your V.O.M. set to test continuity, press and hold the ON/OFF button in the end of the steering handle.
  - **C-1.** If no continuity is noted, go to **Step 5**.
  - **C-2.** If continuity is observed, go to **Step 6**.

Step 5. Disassemble the steering handle assembly (**see figure 2, page 7-6**).

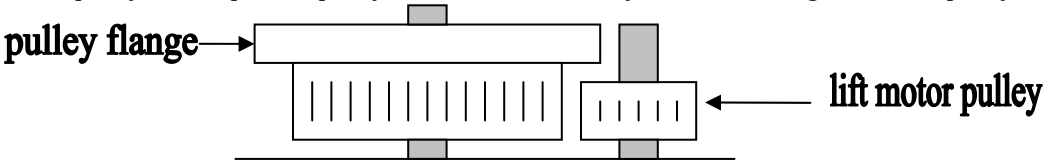
- **A.** Remove the gray steering handle grip and unscrew the four handle screws in order to separate the handle halves.
- **B.** Visually inspect wire connections at the ON/OFF dome switch, the UP/DOWN switches, and the speed control potentiometer. If any corrosion is noted at these points, replace the handle control board assembly (p/n 2994005).
- **C.** If no corrosion is noted, repeat continuity test across black and white coil cord wires (**Step 4**), but press and hold the ON/OFF dome switch with your fingertip. If continuity is now noted but was not observed in **Step 4C**, replace switch plunger (p/n 2053700) and actuator button (p/n 2055115).

Step 6. Disconnect the red, yellow, and green coil cord wires at the main control board.

- **A.** Check resistance across the red and green coil cord wires coming from the handle assembly. With your V.O.M. set to test resistance, it should indicate 1k ohm or slightly higher.
- **B.** With speed control knob off, check resistance across the green and yellow coil cord wires. Your V.O.M. should indicate about 1 ohm. Observe the V.O.M. reading as the speed control knob is turned. The resistance should increase from 1 ohm to 1k ohm as the knob is turned to the highest speed setting.
- **C.** If your test resistance values differ greatly from those listed in **Step 6A & 6B**, or no resistance or continuity is noted, go to **Step 5**. If the resistance values match those indicated here, and the motor unit ran at **Step 3A**, replace the main control board.

LIFT SYSTEM UPGRADE KIT

NOTE: If you encounter a lift system problem on any Vantage motor with a serial number MKAA1501460 or below, check to see if the *Vantage Lift System Upgrade Kit* has been installed.
The upgrade kit consists of the parts shown in **figure 7 (page 7-9)**. Many Vantage motors have already been updated in the field with the new *Lift System Upgrade Kit*, so the serial number may not always be a good indicator if the kit is required. To determine if the motor being serviced has the upgrade kit, examine the lift motor pulley. The top of the pulley will be machined away to allow the larger diameter pulley flange to clear.



(shown with belt removed for clarity)

Vantage motors with a serial number **MKAA1501460** or above will have the improved lift system already installed from the factory. Use the upgrade parts list numbers when ordering any lift system parts for later model Vantage motors.

Case II. The motor runs, but the stow and deploy system fails to operate.

Step 1. Check to ensure proper battery connections. (Consult appropriate wiring diagram for the model being serviced.) **NOTE:** On the 24 and 36 volt models the black (-/negative) and the yellow battery lead must be connected to the negative and positive posts of battery #1. In addition, the red(+/positive) battery lead must be connected to the positive post of battery #2 (24 volt units) or battery #3 (on 36 volt models). If the unit is not connected properly, the power stow/deploy feature will not operate.

Step 2. If lower unit is stuck in fully deployed (down) position, press and hold both UP and DOWN switches simultaneously to "re-set" system (motor should start to lift immediately). This should over-ride the current limit circuit and return the motor lift system to normal operation. Test unit for proper operation.

A. If lift/trim system is not corrected, proceed to **Step 3**.

Step 3. Remove extrusion shield (p/n 2050220) (**see figure 1, page 7-6**), and check to ensure that all wires are connected to the proper control board terminals. (Consult appropriate Vantage wiring diagram.) Visually inspect terminals for corrosion, clean if needed.

Step 4. Test lift system motor to see if it will run when the UP/DOWN switches and control board are bypassed.

A. Disconnect the black and white lift motor wires from the main control board.

B. Apply 12 volts directly to the lift motor leads. (Reverse polarity to reverse the direction of travel.) If the lift system works while bypassing the UP/DOWN switches and control board, go to **Step 4C**.

B-1. If the lift motor fails to run, it is faulty and needs to be replaced. (**See Vantage Disassembly Procedure Steps 1, 2, 3, 3C, & 3C-1 and exploded drawings at the end of this section**.)

B-2. If lift motor runs (audible sound), but motor does not deploy or stow, the lift belt may be slipping due to improper tension (**see Vantage Disassembly Procedure Steps 1, 2, 3, 3B, 3B-1, & 3B-2**) the lift belt may be broken (**see Vantage Disassembly Procedure Steps 1, 2, 3, 3C, & 3C-1**), or the lift yoke is broken or stripped (**see Vantage Disassembly Procedure Steps 1, 2, 3, & 3D**).

C. Check the switches for function and continuity.

C-1. Disconnect the black, blue, and orange coil cord wires. With your V.O.M. set to test continuity, connect the black and orange wires coming from the handle assembly to the V.O.M. probes while depressing the DOWN button.

a. If no continuity is observed, go to **Case I Step 5** for handle disassembly, inspection, and control board replacement.

b. If continuity is noted, proceed to next step.

C-2. Disconnect the orange wire from the V.O.M. and connect the blue wire in its place while depressing the UP button.

a. If no continuity is observed, go to **Case I Step 5** for handle disassembly, inspection, and control board replacement.

b. If continuity is noted, replace the handle control board assembly.

Case III. The motor fails to fully extend / deploy when the down button is pressed. (Motor deploys an inch or two and stops.)

NOTE: The Vantage control board monitors the current demands of the lift system motor. If the board detects higher than normal amp draw, or a spike in amp draw, the control board shuts off the power to the lift system motor. (This is how the lift motor stops when fully deployed.) A Vantage motor lift system that stops prematurely when deploying is binding or is restricted in some manner (lift motor is drawing higher than normal amperage.)

Step 1. Perform an amp draw check of the lift system motor bypassing the control board.

A. Disconnect the black and white lift motor wires from the main control board.

A-1. Using an in-line amp meter, apply 12 volts directly to the black and white wires.

a. Observe the amp draw while the motor is deploying. A properly operating lift system will draw 5-8 amps while deploying

b. Reverse polarity and observe the amp draw while the motor retracting. A properly functioning lift system will draw 10-15 amps.

A-2. If the current demands exceed the amperage values listed, check the following:

a. Check the tension of the lift system drive belt (p/n 2050800). If the tension is too tight the amp draw will be higher than normal. (**See Vantage Disassembly Procedure Step 3, B-2**)

b. If the motor has serial number below MKAG2159171, replace the lower cap (p/n 2996520). On earlier units this cap could shift to the side and bind the lift system causing higher than normal amp draw. (This lower cap change was discussed in our December 2005 Newsletter.)

c. Check to make sure that the white plastic lift gear that is about 2" in diameter (p/n 2990426) is not rubbing on the cluster gear / flange pulley. Shim as necessary using thrust and nylatron washers (p/n 2051703 and p/n 2051705).

d. Check lubrication of the lift screw (p/n 2053400) and lift yoke (p/n 2051510). Inadequate lubrication will cause higher than normal lift motor amp draw.

e. If the air temperature is below freezing, the lubricant in the lift system may be thickened and be too viscous for proper operation.

f. The lift motor may have been overheated and damaged (the lift motor should draw less than two amps while running in a "no load" or "on-the-bench" situation). Sometimes just be sniffing the motor you will be able to determine if it has overheated.

Case IV. Vantage motor lower unit does not steer when the handle is turned from side to side.

Step 1. Disassemble to visually inspect the steering rack and pinion gear. (**See Disassembly Steps 1 & 2**.)

Step 2. Observe steering pinion gear (p/n 2052205) and steering shaft (p/n 2052000) as the steering handle is moved from side to side.

A. If the pinion gear rotates, but the steering shaft does not turn with the pinion gear, the drive lock pin (p/n 2052615) is broken and needs to be replaced. (**See Disassembly Steps 1, 2, 3, & 3A**.)

Vantage Disassembly / Reassembly

Step 1. Remove extrusion shield (p/n 2050220), pointer plug (p/n 2056700), and the pointer knob (p/n 2050100). Remove the leadwire clamps located on the side of the housing using a long shank phillip's screwdriver. Then remove the four screws which hold the control head shroud (p/n 2050210) in place, and disconnect the two indicator lights from the shroud. Note the position of the light with black wires and the light with the white wires for proper reassembly (black wire light is motor, white wire light is power indicator). (**See figure 1, page 7-6**)

Step 2. Remove the three phillip's head screws (p/n 2053415) holding the control head cover assembly (p/n 2050200) in place. Lift the cover off. Remove the latch (p/n 2057500), the latch return spring (p/n 2052711), and the steering shaft roller (p/n 2052210). (**NOTE:** for reassembly the small end of the steering shaft roller must be pointed down.)

Step 3. Disconnect the coil cord wires from the main control board. Using a 9/16" socket or box end wrench, unscrew the top lock nut (p/n 2053107). Remove the flat and cup washers. Lift off the gear housing upper cap (p/n 2056510) and gear housing ring. Unscrew the three screws (p/n 2053402) and remove the lower gear housing cap (p/n 2056515) along with the gear housing o-ring (p/n 2054600). (**See figure 3, page 7-7**.) Removing the gear housing cap exposes the steering gear and the lift belt/flange pulley/lift gear assembly of the Vantage motor lift system.

A. If it was determined in **Case III Step 2A** that the drive lock pin (p/n 2052615) (**see figure 4, page 7-7**) was sheared, the broken pin can be replaced at this point. Use a 1/8" diameter punch to remove any broken pieces of the pin left in the steering gear/steering shaft. Install a new pin leaving approximately ¼" to 5/16" protruding from the pinion gear on the same side as the "D" flat on the steering shaft. Reassemble the unit in reverse order of disassembly to complete the repair.

B. If it was determined in **Case II Step 3B-2** that the lift belt was slipping, disassemble the Vantage motor to allow examination of the lift system. This will allow determination if the *Vantage Lift System Upgrade Kit* is needed. (See **NOTE** on top of **page 7-2** for information on how to identify lift system.)

B-1. If examination of the lift system indicates that *Lift System Upgrade Kit* needs to be installed, order and install Minn Kota p/n 2776517 (per instructions on page 7-4, **Step 3C-1**).

B-2. If examination of the lift system indicates that the motor has the newer lift system installed, tighten the belt by loosening the 3 screws (p/n 831-070) that hold the lift motor in place. **NOTE:** To access one of these screws, you will need to rotate the flange pulley/cluster gear assembly (**figure 7 on page 7-9**). Loosen the setscrew (p/n 2053420) and then, using a 5/32" allen wrench, rotate the belt tensioner (p/n 2058411). Turning the allen wrench CW or CCW will move the motor to adjust the belt tension. With the belt tight, retighten the 3 motor screws and the belt tensioner setscrew. Check motor lift system operation, and reassemble in reverse order of disassembly.

C. If it was determined in **Case II Step 3B-1**that the lift motor needs to be replaced or in **Case II 3B-2** that the lift belt is broken, examine the lift system to determine if it is the new or older type. (See **NOTE** on top of **page 7-2** for information on how to identify lift system.) If examination confirms that the motor has the earlier type lift system, order and install p/n 2776517 *Lift System Upgrade Kit*.

C-1. To disassemble the Vantage motor for installation of the *Lift System Upgrade Kit*, lower the motor about 7 to 8 inches down from the fully retracted position. If necessary, you may connect the lift motor leads to 12 volts to lower the motor unit or you may rotate the lift gear (p/n 2052208) counter-clockwise (CCW) by hand to lower the motor unit. Failure to lower the motor will make further disassembly difficult and may result in damage to the unit.

a. Use a 1/8" diameter punch to remove the pin (p/n 2052620) from the lift gear (p/n 2052208) and lift screw shaft (p/n 2053400).

b. Remove the lift gear from the lift screw shaft. (**See figure 5, page 7-8**.)

c. Remove the 2 screws (p/n 2053414) that hold the steering shaft (p/n 2052000) and steering shaft bearing (p/n 2057306) in place. Note the position of the "D" flat on the steering shaft in relation to the motor lower unit. Proper reassembly requires that the "D" flat be in the same position as it was prior to disassembly (relative to the motor lower unit).

d. Lift the steering shaft, steering pinion gear, and bearing assembly straight up and out of the top plate (p/n 2051900).

e. Using a 5/16" nut driver, remove the 4 screws (p/n 2053413) that hold the top plate in place on the housing (p/n 2056505). (**See figure 5, page 7-8**.)

f. Remove the screw and washer (p/n 2053415 and 2051716) that hold the motor leadwire in place.

g. Disconnect the motor leads and lift motor wires from the control board. Remove the 2 control board mounting screws and insulating washers (p/n 2053407and 2261712). (**See figure 3, page 7-7**.)

h. Lift the top plate and motor assembly off the housing and install the new top plate, lift motor, and lift system included with the *Lift System Upgrade Kit* (p/n 2776517).

i. Reassemble the motor in reverse order of disassembly. Adjust lift belt tension on the new upgrade kit as outlined in **Step 3B-2** (above).

j. Test motor for proper operation upon completion of the Lift System Upgrade Kit installation.

D. If it was determined in **Case II Step 3B-2** that the lift yoke (p/n 2051510) (**see figure 6, page 7-8**) is broken or stripped further disassembly is required. **NOTE:** the Vantage motor uses a retractable tape spring to hold/control the two-conductor wire that goes to the motor lower unit. The wire control system consists of two parts, the wire clamp assembly (p/n 2053200, 2053205, & 2053417) and the tape spring assembly (p/n 2051900, 2052305, 2052610, 2052705, & 2053418). (**See figure 5, page 7-8**.) Both of these items are slid onto the raised "rib" located on the inside surface of the housing (p/n 2056505). The lower wire clamp is held in place by means of a small plastic "finger" that catches in a ¼" diameter hole in the Vantage motor housing (p/n 2056505). (The hole is located on the transom bracket side of the housing 9 inches down from the top.) Use a 1/4" diameter pin punch in this hole. From the outside, push in the end of the finger to release the lower wire clamp and slide it up and lift the tape spring assembly and wire clamp off of the rib. Next, while supporting the Vantage motor lower unit, use the 5/16" nut driver to remove the four screws (p/n 2053414) that hold the lower support cage (p/n 2990420) assembly into the housing (p/n 2056505). After removing these four screws the entire motor lower unit and shaft, lift screw (p/n N 2053400), lift screw yoke (p/n 2051510), and yoke bearing race (p/n 2056200) can be lowered out the bottom of the Vantage housing. (**See figures 5 & 6, page 7-8**.) Remove the lower wire clamp, wire tie, and tape spring assembly from the motor wire leads. Then remove the two screws (p/n 2053401) that hold the yoke bearing to the motor shaft. Remove the coil spring (p/n 2990429) and washer from the top end of the lift screw shaft. Remove the broken/stripped lift screw yoke from the lift screw shaft. If necessary, turn the lift screw to unscrew the old yoke and bearing race assembly. Slide the old parts up and off the motor wire leads. Install the required new parts and reassemble the Vantage motor in reverse order of disassembly. Take special care not to twist the motor wire leads and to reinstall the wire tie, lower wire clamp, and the tape spring in the same manner and position they were in prior to disassembly.

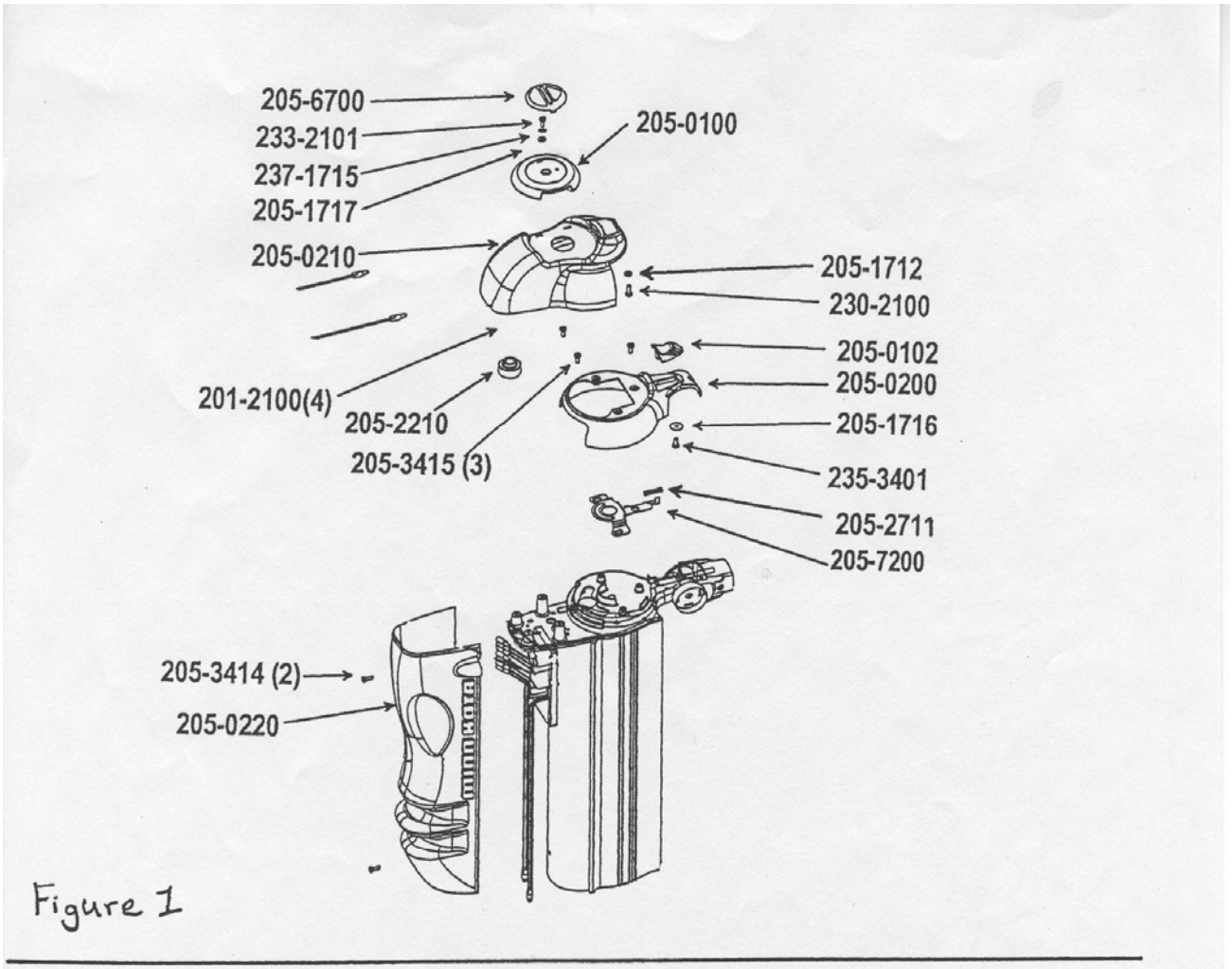


Figure 1

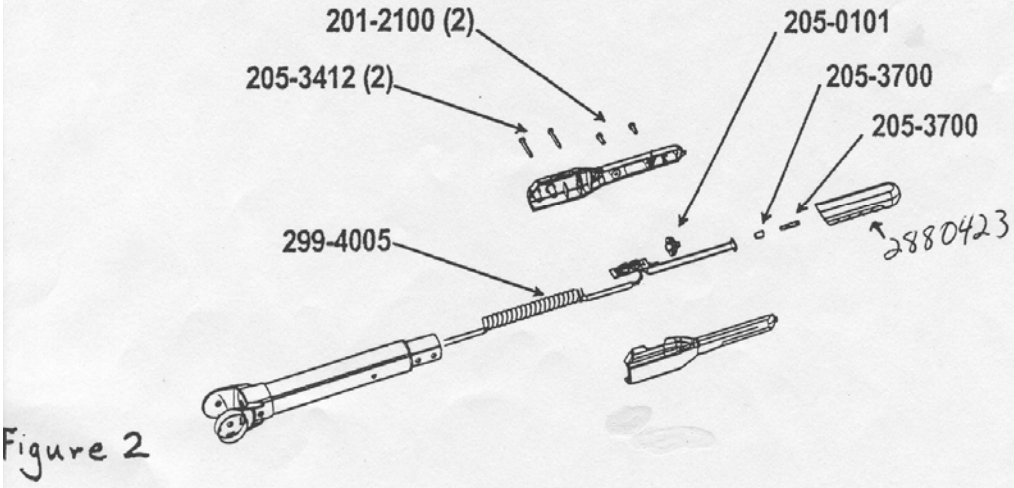


Figure 2

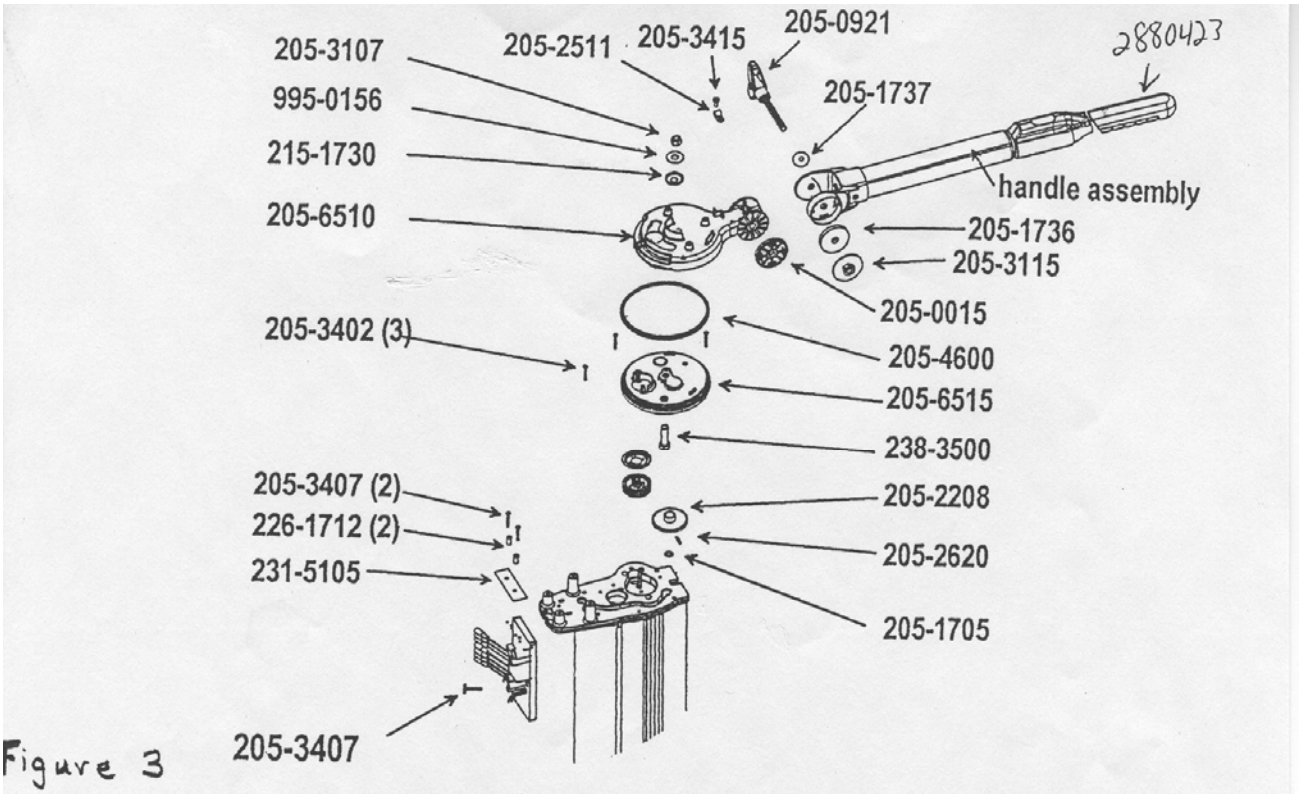


Figure 3

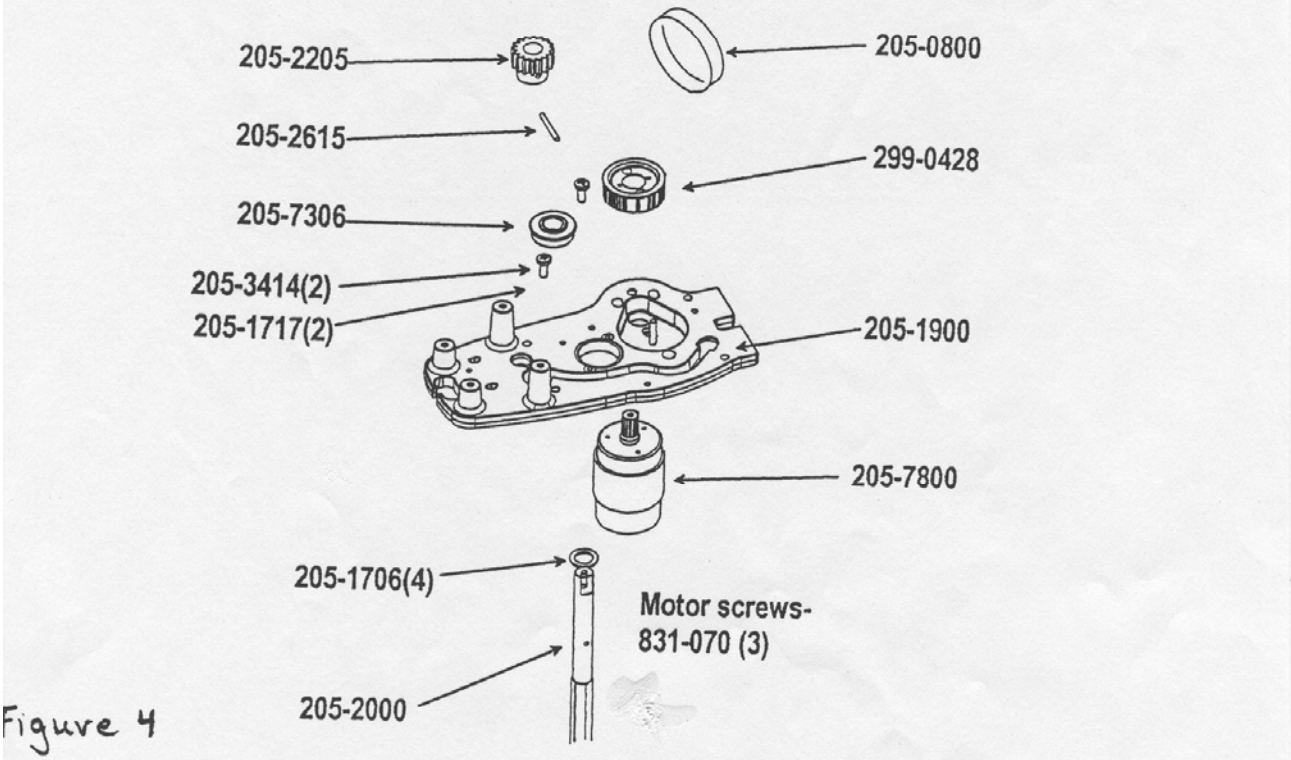


Figure 4

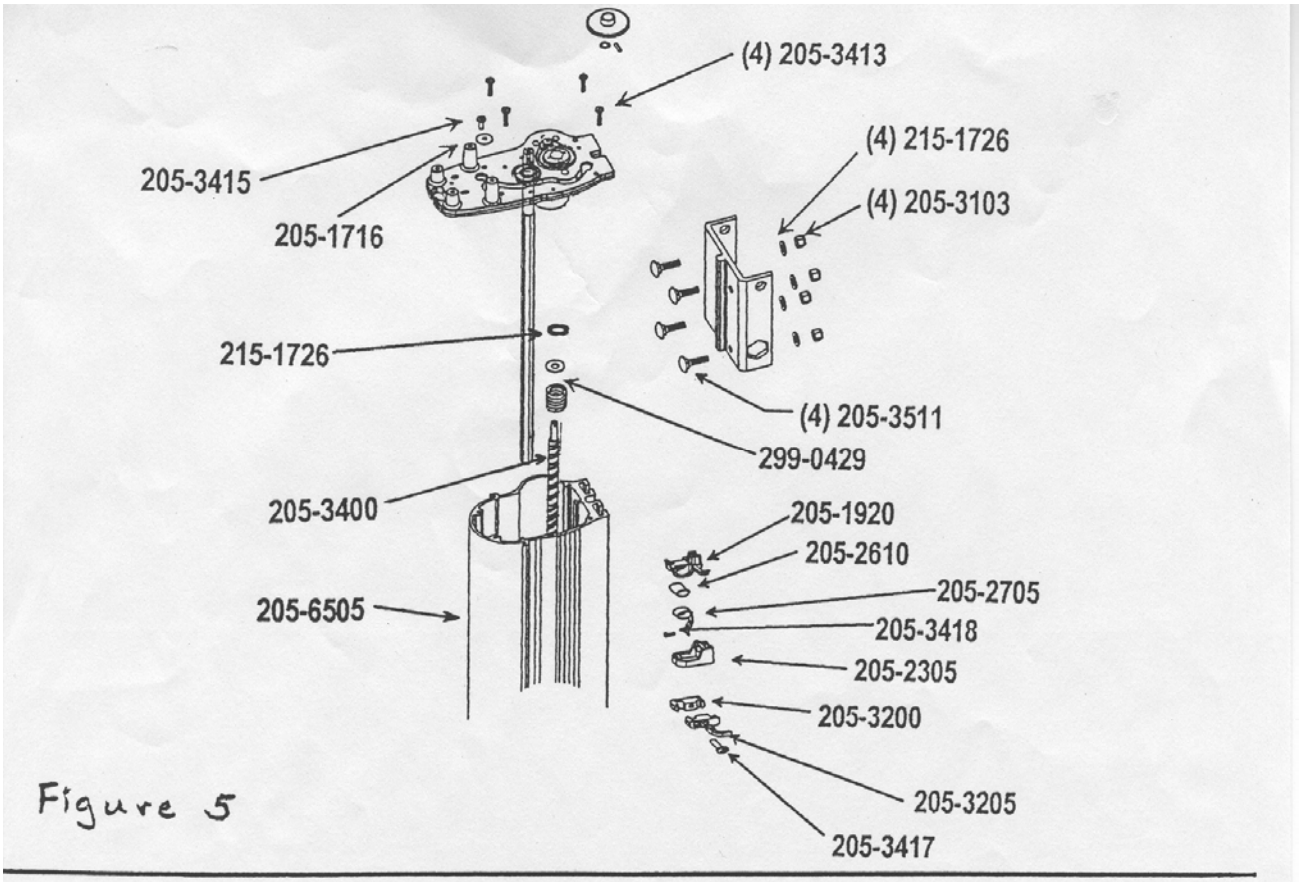


Figure 5

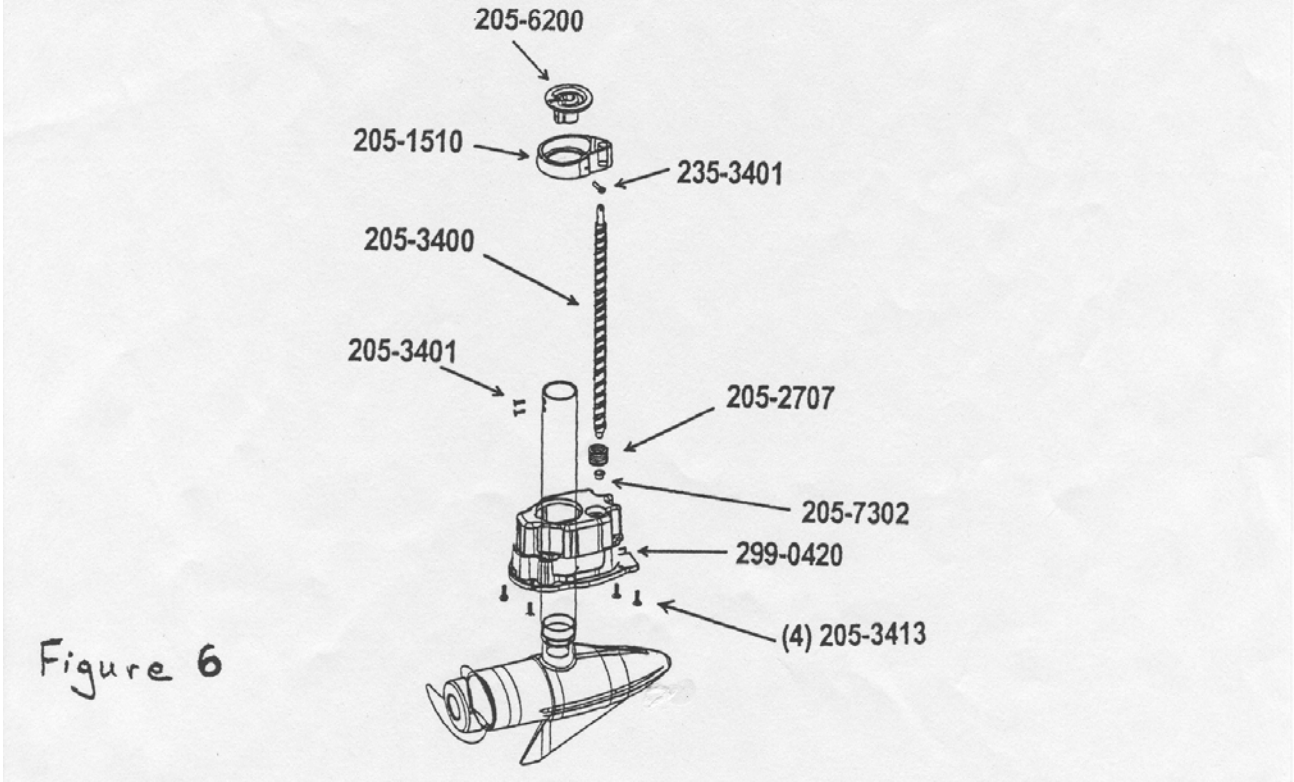


Figure 6

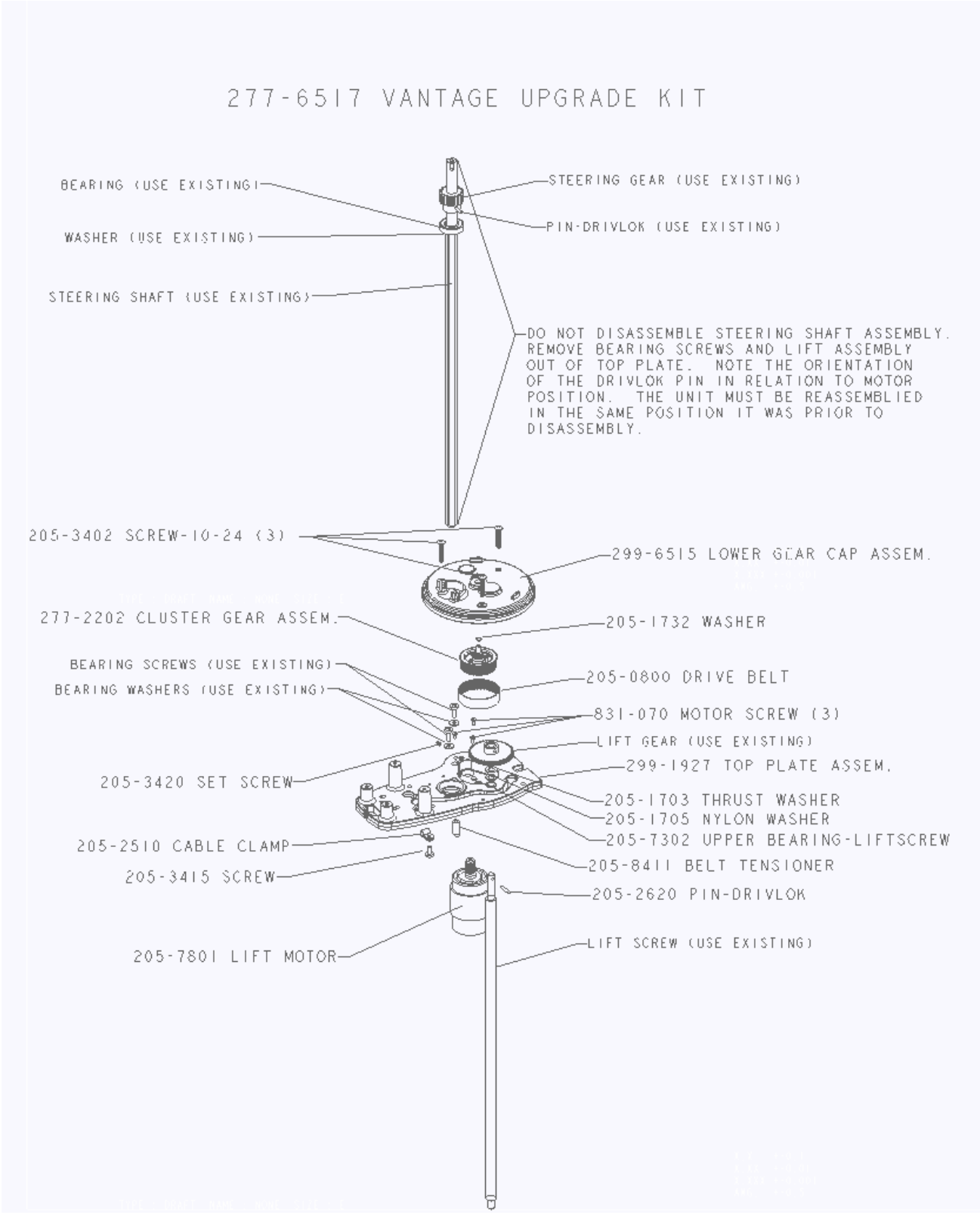

277-6517 VANTAGE UPGRADE KIT
BEARING (USE EXISTING)
WASHER (USE EXISTING)
STEERING SHAFT (USE EXISTING)
STEERING GEAR (USE EXISTING)
PIN-DRIVLOK (USE EXISTING)
DO NOT DISASSEMBLE STEERING SHAFT ASSEMBLY. REMOVE BEARING SCREWS AND LIFT ASSEMBLY OUT OF TOP PLATE. NOTE THE ORIENTATION OF THE DRIVLOK PIN IN RELATION TO MOTOR POSITION. THE UNIT MUST BE REASSEMBLIED IN THE SAME POSITION IT WAS PRIOR TO DISASSEMBLY.
205-3402 SCREW-10-24 (3)
299-6515 LOWER GEAR CAP ASSEM.
277-2202 CLUSTER GEAR ASSEM.
205-1732 WASHER
BEARING SCREWS (USE EXISTING)
BEARING WASHERS (USE EXISTING)
205-0800 DRIVE BELT
831-070 MOTOR SCREW (3)
LIFT GEAR (USE EXISTING)
299-1927 TOP PLATE ASSEM.
205-3420 SET SCREW
205-1703 THRUST WASHER
205-1705 NYLON WASHER
205-7302 UPPER BEARING-LIFTSCREW
205-2510 CABLE CLAMP
205-8411 BELT TENSIONER
205-3415 SCREW
205-2620 PIN-DRIVLOK
205-7801 LIFT MOTOR
LIFT SCREW (USE EXISTING)

Figure 7

Chapter 8.

PowerDrive (PD) Models

(Corded foot pedal, non-AutoPilot, non-Genesis, non-Terrova)

This PowerDrive Repair Manual (Section 3) is divided into 2 parts.

Part I.	pertains to V2 models 2007 and later (s/n AH and later).	**pages 8-1**through **8-2**
Part II.	pertains to motors prior to 2007 (s/n prior to AH).	**pages 8-3** through **8-6**

PART I.

V2 motors manufactured for model 2007 and later (s/n AH and later).

PART I - Case I. Drive Housing fails to steer left or right.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for any corroded connections. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal or test the original foot pedal by performing *Foot Pedal PCB Test Procedure* (see page 8-2).

A. If test pedal properly steers motor or if the original pedal tests bad as outlined on page 8-2, then original foot pedal is faulty. Replace foot pedal board, if necessary.

B. If test pedal does not properly steer motor or if original pedal tests okay as outlined on page 8-2, then check the drive housing.

B-1. Connect 12-volt power source directly to drive housing leads. If drive housing does not steer, open drive housing. Inspect servo motor and drive gears for binding/lack of lubrication. Service drive housing to correct malfunction, as needed. If necessary, re-lubricate the bushing and sleeve contact surfaces with Schaeffer's #238 Moly Ultra Supreme grease (Minn Kota p/n 2307720).

PART II - Case II. Motor (lower unit) fails to run or runs intermittently.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for any corroded connections. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal or test the original foot pedal by performing *Foot Pedal PCB Test Procedure* (see page 8-2). Replace, as needed.

B. If test pedal does not properly control propeller or if original pedal tests okay as outlined on page 8-2, go to **Step 3**.

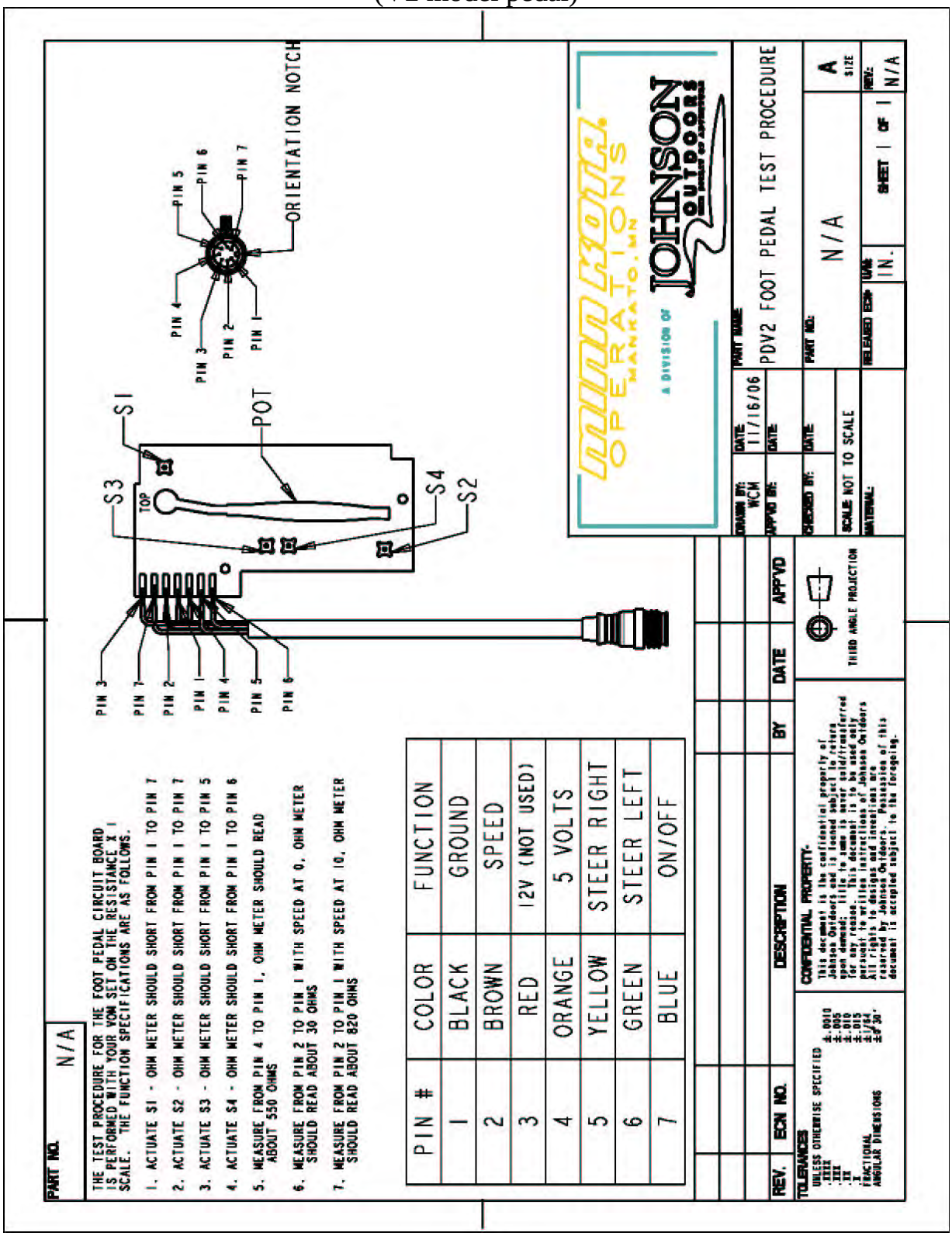
Step 3. Check to see if lower unit runs properly.

A. Connect 12 volts directly to the red and black brush leads at the top of the motor shaft (in the control box). The motor should run. If not, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as needed. If the motor operates properly, go to **Step 4**.

Step 4. Check for control board output by hooking up test light (or V.O.M. probes) to board output terminals (consult appropriate wiring diagram). Use known good test pedal. Connect battery leads to proper voltage. Turn the foot pedal to CON (constant ON) and vary the speed selector. If there is no control board output, the main control board is defective. Replace main control board.

V2 Foot Pedal Test Procedure

(V2 model pedal)


PART NO. N/A
THE TEST PROCEDURE FOR THE FOOT PEDAL CIRCUIT BOARD IS PERFORMED WITH YOUR VOM SET ON THE RESISTANCE X 1 SCALE. THE FUNCTION SPECIFICATIONS ARE AS FOLLOWS.
1. ACTUATE S1 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 7
2. ACTUATE S2 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 7
3. ACTUATE S3 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 5
4. ACTUATE S4 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 6
5. MEASURE FROM PIN 4 TO PIN 1, OHM METER SHOULD READ ABOUT 550 OHMS
6. MEASURE FROM PIN 2 TO PIN 1 WITH SPEED AT 0, OHM METER SHOULD READ ABOUT 30 OHMS
7. MEASURE FROM PIN 2 TO PIN 1 WITH SPEED AT 10, OHM METER SHOULD READ ABOUT 820 OHMS
PIN # COLOR FUNCTION
1 BLACK GROUND
2 BROWN SPEED
3 RED 12V (NOT USED)
4 ORANGE 5 VOLTS
5 YELLOW STEER RIGHT
6 GREEN STEER LEFT
7 BLUE ON/OFF
S1
S2
S3
S4
POT
TOP
ORIENTATION NOTCH
PIN 1
PIN 2
PIN 3
PIN 4
PIN 5
PIN 6
PIN 7
MINN KOTA
OPERATIONS
MANKATO, MN
A DIVISION OF
JOHNSON OUTDOORS
DRAWN BY: WCM
DATE 11/16/06
CHECKED BY:
APPVD BY:
DATE
SCALE: NOT TO SCALE
MATERIAL:
PART NAME: PDV2 FOOT PEDAL TEST PROCEDURE
PART NO: N/A
RELEASED ENG:
UNIT: IN.
SIZE A
SHEET 1 OF 1
REV: N/A
REV. ECN NO. DESCRIPTION BY DATE APP'VD
TOLERANCES
UNLESS OTHERWISE SPECIFIED
.XXXX ±.0010
.XXX ±.005
.XX ±.010
.X ±.015
FRACTIONAL ±1/64
ANGULAR DIMENSIONS ±1°30'
THIRD ANGLE PROJECTION
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PART II.

Motors manufactured prior to model year 2007 (prior to s/n AH).

PART II - Case I. Drive Housing fails to steer left or right.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for any corroded connections. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal or test the original foot pedal by performing *Foot Pedal PCB Test Procedure* (see page 8-6).

C. If test pedal properly steers motor or if the original pedal tests bad as outlined on page 8-6, then original foot pedal is faulty. Disassemble faulty pedal to inspect if actuators are properly making contact on foot pedal board. Visually inspect foot pedal control board for collapsed / burnt dome switches. Replace foot pedal board, if necessary.

A-1. If dome switches are burnt, check drive housing for short between either of the drive housing wires and the metal portion of the drive housing itself. To do this, use a V.O.M. to check for continuity between the drive housing lead and a screw on the underside of the drive housing.

A-2. If a short is found, disassemble the drive housing and insulate the wire terminals at the drive housing's servo motor to correct the shorted condition.

A-3. Reassemble the drive housing and again check for shorts.

D. If test pedal does not properly steer motor or if original pedal tests okay as outlined on page 8-6, then check the drive housing.

B-1. Connect 12-volt power source directly to drive housing leads. If drive housing does not steer, open drive housing. Inspect servo motor and drive gears for binding/lack of lubrication. Service drive housing to correct malfunction, as needed. If necessary, re-lubricate the bushing and sleeve contact surfaces with Schaeffer's #238 Moly Ultra Supreme grease (Minn Kota p/n 2307720).

PART II - Case II. Motor (lower unit) fails to run or runs intermittently.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for any corroded connections. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal or test the original foot pedal by performing *Foot Pedal PCB Test Procedure* (see page 8-6).

A. If test pedal properly controls propeller speed or if the original pedal tested bad, then original foot pedal is faulty. Disassemble faulty pedal to inspect if actuators are properly making contact on foot pedal board. Visually inspect foot pedal control board for collapsed / burnt dome switches or bad soft pot. Replace foot pedal control board, if necessary.

B. If test pedal does not properly control propeller or if original pedal tests okay, go to **Step 3**.

Step 3. Check to see if lower unit runs properly.

A. Connect 12 volts directly to the red and black brush leads at the top of the motor shaft (in the control box). The motor should run. If not, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as needed. If the motor operates properly, go to **Step 4**.

Step 4. Check for control board output by hooking up test light (or V.O.M. probes) to board output terminals (consult appropriate wiring diagram). Use known good test pedal. Connect battery leads to proper voltage. Turn the foot pedal to CON (constant ON) and vary the speed selector. If there is no control board output, the main control board is defective. Replace main control board.

PART II - Case III. Foot pedal sticks right/left when steering.

Step 1. Inspect actuators on underside of foot pedal for sand/dirt/grit.

- **A.** Disassemble and clean contaminated actuators. Replace components as required.
- **B.** Reassemble foot pedal, leave actuators dry or use a dry lubricant to avoid further contamination with sand/dirt/grit.
- **C.** NOTE: If foot pedal sticks while customer is fishing, he may simply swish the foot pedal in the water to temporarily flush the sand/dirt/grit from the actuator surfaces.

PART II - Case IV. MOM/CON switch lever will not stay down in CON position.

Step 1. From the underside of footpedal, remove the 3 screws holding the slide control and switch lever in place.

- **A.** Remove screw holding the white plastic continuous actuator in place.
- **B.** Place washer (P/N 2301731) between actuator and foot pedal base.
- **C.** Reassemble slide-control and MOM/CON switch assembly. Test for proper operation.

PART II - Case V. Motor won't steer or steers slowly at higher thrust settings.

Step 1. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in the battery leadwire for corrosion and security.

Step 2. Disassemble motor to separate the drive housing from the motor and tube and bowplate extrusion assembly.

- **A.** Remove the six screws holding the top and bottom halves of the drive housing together. (Note: the top and bottom halves of the drive housing are "pinned" together at the corners with roll pins. The two halves will need to be pried apart.)
- **B.** Inspect the drive housing motor, paying special attention to the drive housing motor armature shaft and motor bushings. Test run to verify proper high speed operation and RPM.
- **C.** Remove the drive housing sleeve and bushings. Thoroughly clean the bushing and sleeve contact surfaces of all residue and old lubricant. Re-lubricate the bushing and sleeve contact surfaces with Schaeffer's #238 Moly Ultra Supreme grease (Minn Kota p/n 2307720). Reassemble the drive housing taking special care to properly realign the drive housing pins, shafts, motor, and gears. Prior to installing and tightening the six drive housing case screws, test run the drive housing by applying 12 volts directly to the drive housing wire leads. If the drive housing motor runs properly, then make sure there are no gaps between the case halves case halves (a rubber mallet works well to seat the case halves flush/tight). Install and tighten case screws.
- **D.** Reassemble the drive housing to the bow plate/extrusion assembly. Slide the motor and tube through the drive housing. Reconnect wires in the control box. Test operation of reassembled motor to complete the repair.

PART II - Case VI. Motor is loose in the cradle.

Step 1. Check / replace the pivot pads (P/N 2305101), as needed. The pads tend to take a set over time.

Step 2. If unit being serviced is a year 2001 or later "Grip Glide" unit, ensure the Grip Glide latch handle firmly engages the latch collar on the composite shaft.

- **A.** Loosen latch collar clamping screw. Rotate the latch collar clockwise on the shaft (when viewed from above) to screw the latch collar down towards the motor lower unit. (The collar and shaft are threaded.)
- **B.** Check to verify that the catch on the latch handle now firmly engages the latch collar. If necessary, re-adjust latch collar position. Tighten the clamping screw to hold the collar in place.

PART II - Case VII. Motor is tight in the cradle and difficult to stow/deploy.

Step 1. Lubricate the composite shaft with a silicone spray or Armor All®.

Step 2. Adjust the latch collar.

A. Loosen latch collar clamping screw. Rotate the latch collar counter-clockwise on the shaft (when viewed from above) to screw the latch collar up away from the motor lower unit. (The collar and shaft are threaded.)

B. Check to verify that the catch on the latch handle firmly engages the latch collar. If necessary, re-adjust latch collar position. Tighten the clamping screw to hold the collar in place.

Step 3. Verify the correct motor rests are used. (Part numbers are molded on the motor rests)

2303933 motor rest – right 4" motor assemblies
2303938 motor rest – left 4" motor assemblies

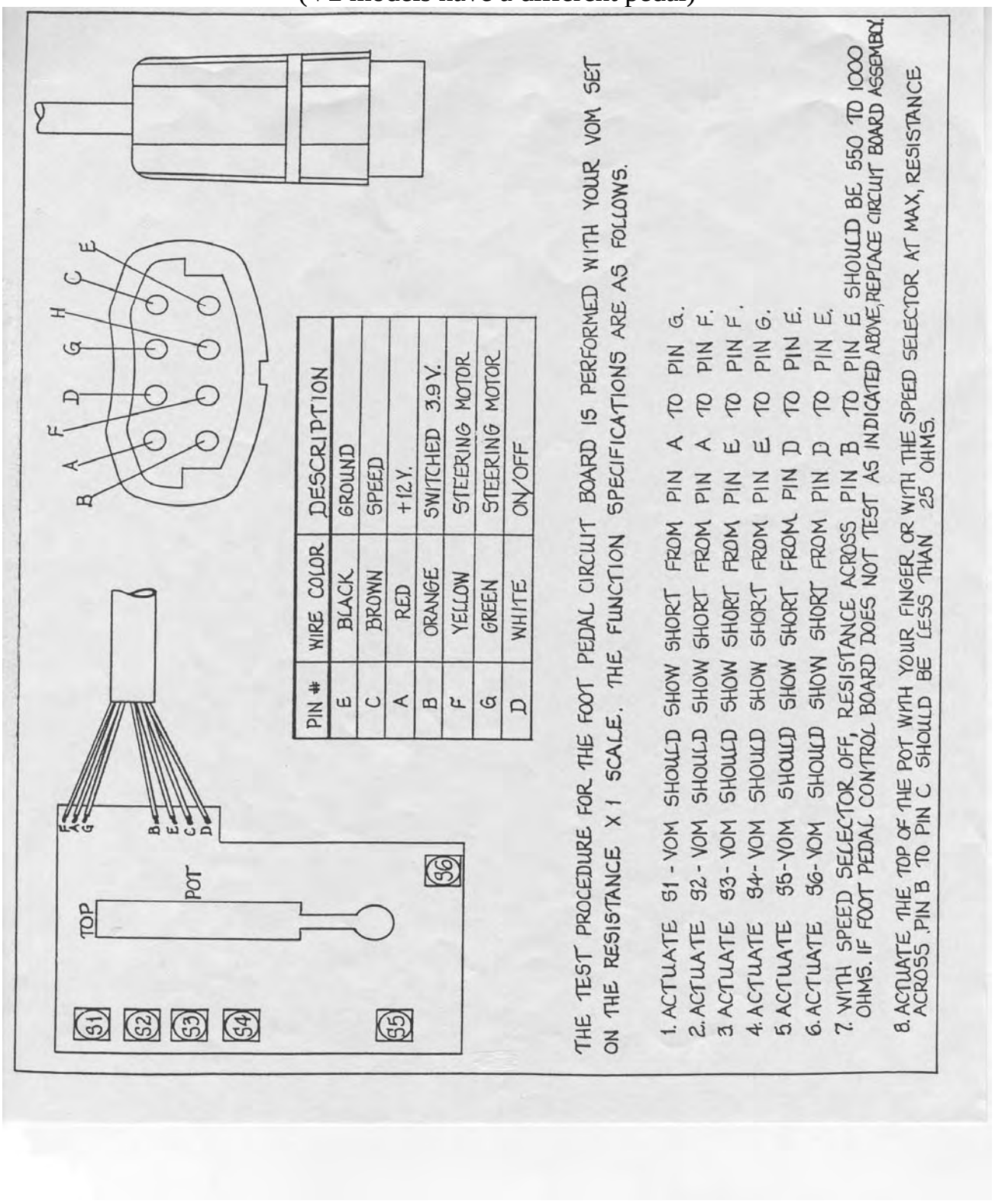
2303932 motor rest – right 3-5/8" motor assemblies
2303937 motor rest – left 3-5/8" motor assemblies

2303930 motor rest – right 3-¼" motor assemblies
2303935 motor rest – left 3-¼" motor assemblies

Step 4. Replace the pivot pads (P/N 2305103).

Corded Foot Pedal Test Procedure

(V2 models have a different pedal)



PIN #	WIRE COLOR	DESCRIPTION
E	BLACK	GROUND
C	BROWN	SPEED
A	RED	+12 V.
B	ORANGE	SWITCHED 3.9 V.
F	YELLOW	STEERING MOTOR
G	GREEN	STEERING MOTOR
D	WHITE	ON/OFF

THE TEST PROCEDURE FOR THE FOOT PEDAL CIRCUIT BOARD IS PERFORMED WITH YOUR VOM SET ON THE RESISTANCE X 1 SCALE. THE FUNCTION SPECIFICATIONS ARE AS FOLLOWS.

1. ACTUATE S1 - VOM SHOULD SHOW SHORT FROM PIN A TO PIN G.
2. ACTUATE S2 - VOM SHOULD SHOW SHORT FROM PIN A TO PIN F.
3. ACTUATE S3 - VOM SHOULD SHOW SHORT FROM PIN E TO PIN F.
4. ACTUATE S4 - VOM SHOULD SHOW SHORT FROM PIN E TO PIN G.
5. ACTUATE S5 - VOM SHOULD SHOW SHORT FROM PIN D TO PIN E.
6. ACTUATE S6 - VOM SHOULD SHOW SHORT FROM PIN D TO PIN E.
7. WITH SPEED SELECTOR OFF, RESISTANCE ACROSS PIN B TO PIN E SHOULD BE 550 TO 1000 OHMS. IF FOOT PEDAL CONTROL BOARD DOES NOT TEST AS INDICATED ABOVE, REPLACE CIRCUIT BOARD ASSEMBLY.
8. ACTUATE THE TOP OF THE POT WITH YOUR FINGER OR WITH THE SPEED SELECTOR AT MAX, RESISTANCE ACROSS PIN B TO PIN C SHOULD BE LESS THAN 25 OHMS.

Chapter 9.

AutoPilot (PD/AP) Models

(Corded foot pedal models, non-Genesis, non-Terrova)

This AutoPilot Repair Manual is divided into two parts.	
Part I. pertains to both V2 models (s/n AH and later) and Grip Glide models (s/n AB through AI). (AutoPilot switch is located on the top of the control box cover.)	**pages 9-1** through **9-7**
Part II. pertains to motors manufactured prior to model year 2001 (s/n AA & earlier). (AutoPilot switch is located on the lower speed control cover.)	**pages 9-8** through **9-14**

PART I.

Motors manufactured for model year 2001 and later (s/n AB and later).
These motors incorporate either the "Grip Glide" handle or the "Deploy Assist" lever.

PART I - Case I. Drive Housing will not steer in (either or both directions) with the AP switch turned ON or OFF.

(This is not a defect in the main control board. The steering logic is NOT in the main control board.)

Step 1. Check to ensure proper voltage and polarity at battery. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security. Visually check to see that all wires are attached proper control board terminals. Consult the appropriate wiring diagram for the model and board being tested. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal *or* test pedal by performing *Foot Pedal PCB Test Procedure* (see page 9-6 or 9-7).

A. If test pedal properly steers motor or if the original pedal tests bad, the original foot pedal is faulty. Disassemble defective pedal to inspect actuators and dome switches. Replace foot pedal, if necessary.

B. If test pedal does not properly steer the motor or if the original pedal tests okay, proceed to next step.

Step 3. Test the drive housing for proper operation. Disconnect the drive housing lead wires and apply 12 volts directly to the white and black wires. Observe drive housing for rotation. Reverse the polarity, and the drive housing should reverse the direction of rotation. Repair or replace drive housing, if required. If drive housing tests okay, proceed to next step.

Step 4. Check continuity of the individual coil cord wires with the coil cord stretched out to length. If you find a break in continuity in any of these wires, the coil cord is defective. Replace coil cord, if required. (See page 9-4 for the specific effects of broken/intermittent coil cord wires.)

Step 5. If above steps test fine, the AutoPilot compass control board assembly in the upper control box is faulty. Replace compass board assembly.

PART I - Case II. Motor steers slowly at higher thrust settings.

Step 1. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in the battery leadwire for corrosion and security.

Step 2. Check to insure that wire of adequate gauge has been used in the boat's trolling motor circuit. (Wiring of inadequate gauge will result in a voltage drop to the motor and steering circuit at higher thrust settings. If, after insuring that all wiring and connections are good, the steering is still slow at high thrust, proceed to **Step 3**.

Step 3. Disassemble motor to separate the drive housing from the motor and tube and bowplate/extrusion assembly.

A. Remove the six screws holding the top and bottom halves of the drive housing together. (Note: the top and bottom halves of the drive housing are "pinned" together at the corners with roll pins. The two halves will need to be pried apart.)

B. Inspect the drive housing motor, paying special attention to the drive housing motor armature shaft and motor bushings. Test run to verify proper high speed operation and RPM.

C. Remove the drive housing sleeve and bushings. Thoroughly clean the bushing and sleeve contact surfaces of all residue and old lubricant. Re-lubricate the bushing and sleeve contact surfaces with Bel-Ray Termalene #699 grease (Minn Kota p/n 2307720). Reassemble the drive housing taking special care to properly realign the drive housing pins, shafts, motor, and gears. Prior to installing and tightening the six drive housing case screws, test run the drive housing by applying 12 volts directly to the drive housing wire leads. If the drive housing motor runs properly, then make sure there are no gaps between the case halves (a rubber mallet works well to seat the case halves flush/tight). Install and tighten case screws.

D. Reassemble the drive housing to the bow plate/extrusion assembly. Slide the motor and tube through the drive housing. Reconnect all wires in the control box. Test for proper operation.

PART I – Case III. All functions are dead.

Step 1. Check for proper battery voltage and polarity at the control board input terminals. Visually check for poor or corroded connections. Check for proper wiring of control board (consult appropriate wiring diagram).

Step 2. Defective main control board. Replace main control board.

PART I – Case IV. Motor steers properly, but motor lower unit does not run.

Step 1. Check for proper voltage *at the control board input terminals*. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for corroded connections. Clean/rewire properly, if necessary.

Step 2. Check motor with known good test foot pedal or test the foot pedal by performing the *Foot Pedal Test Procedure* (see page 9-6 or 9-7).

A. If test pedal properly controls all motor functions or if the original foot pedal tests bad, the original foot pedal is faulty. Replace foot pedal.

B. If motor lower unit does not run properly with test pedal or if the original pedal tests fine, go to **Step 3**.

Step 3. Check to see if lower unit runs properly.

A. Connect 12 volts directly to the red and black brush leads at the top of the motor shaft (in the control box). The motor should run. If not, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as necessary. If the motor operates properly, proceed to **Step 4**.

Step 4. If **Steps 1**, **2**, and **3** test okay, the main control board is faulty and needs to be replaced.

PART I – Case V. AutoPilot steering stops after approximately 7 seconds of continuous steering in one direction.

Step 1. This is normal. It is designed to prevent the coil cord from wrapping around the shaft of the motor. If you steer continuously in one direction until the servo motor stops, you can momentarily release the steering and then re-engage it in the same or opposite direction.

PART I – Case VI. AutoPilot function is erratic and doesn't maintain a heading.

Step 1. Make sure motor is mounted within 5 degrees of level (the compass card with the graduated markings must be floating level) and there are no ferrous metal objects near the motor that may be affecting the compass (including screws/nuts). While maintaining a level compass, rotate the control box and observe the compass card. The card should remain stationary (i.e. card should not have lost its magnetic north reference) as the control box is turned. If the compass card sticks or "hangs up" it is faulty, and the compass assembly needs to be replaced.

A. Inspect oil level in compass capsule looking for a leaky capsule. NOTE: Examine the red compass grommets. If the compass has leaked fluid the grommets will be swollen almost double their normal size.

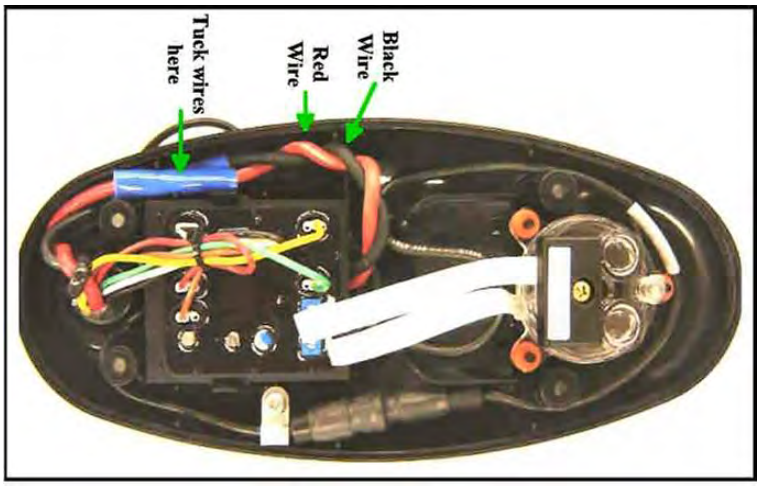
B. If any sign of compass fluid leakage is evident, replace the compass control board assembly.

Step 2. Check motor for excessive vibration. Inspect propeller and propeller shaft for damage. (Excessive vibration can cause the AutoPilot compass to oscillate causing erratic operation.)

Step 3. Check for proper voltage to motor <u>while motor is under load</u>. AutoPilot steering is susceptible to erratic operation in low voltage situations. (Use of inadequate gauge wire in boat or any leadwire extension can result in voltage drop / low voltage to the motor; as can an inadequate or a corroded plug / plug receptacle.)

Step 4. Check continuity of brown, red, white, and black small gauge wires in the coil cord with the coil cord stretched out to length. If you find a break in continuity in any of these wires, the coil cord is defective. Replace coil cord, if required. (See page 9-4 for the specific effects of broken/intermittent coil cord wires.)

Step 5. Replace compass control board assembly with latest part. Ensure the red and black leads from the lower unit and the leads from the coil cord are twisted as per the following picture:



PART I - Case VII. AutoPilot changes directions with speed changes.

Step 1. Small direction changes with speed changes are normal.

Step 2. If direction changes are significant, perform the *AutoPilot Calibration Procedure* (see page 9-5).

PART I - Case VIII. Foot pedal sticks right/left when steering.

Step 1. Inspect actuators on underside of foot pedal for sand/dirt/grit.

A. Disassemble and clean contaminated actuators. Replace components, if required.

B. Reassemble foot pedal, leave actuators dry or use a dry lubricant to avoid further contamination with sand/dirt/grit.

PART I - Case IX. MOM/CON switch lever will not stay down in CON position or, on V2 models, motor does not stay running.

For Grip Glide Motors:

Step 1. From the underside of the footpedal, remove the 3 screws holding the slide control and switch lever in place.

A. Remove screw holding the white plastic continuous actuator in place.

B. Place shim (P/N 2301731) between actuator and pedal base.

C. Reassemble slide-control and MOM/CON switch assembly. Test for proper operation.

For V2 Motors:

Step 1. From the underside of the footpedal, tighten screws beneath MOM/CON switch.

PART I - Case X. Motor is loose in the cradle.

Step 1. Check / replace the pivot pads (P/N 2305103), as needed. The pads tend to flatten or soften over time.

Step 2. Ensure the latch on the Grip Glide handle or Deploy Assist lever firmly engages the latch collar on the composite shaft.

- **A.** Loosen latch collar clamping screw. Rotate the latch collar clockwise on the shaft (when viewed from above) to screw the latch collar down towards the motor lower unit. (The collar and shaft are threaded.)
- **B.** Check to verify that the catch on the handle or lever now firmly engages the latch collar. If necessary, re-adjust latch collar position. Tighten the clamping screw to hold the collar in place.

PART I - Case XI. Motor is tight in the cradle and difficult to stow/deploy.

Step 1. Lubricate the composite shaft with a silicone spray or Armor All®.

Step 2. Adjust the latch collar.

- **A.** Loosen latch collar clamping screw. Rotate the latch collar counter-clockwise on the shaft (when viewed from above) to screw the latch collar up away from the motor lower unit. (The collar and shaft are threaded.)
- **B.** Check to verify that the catch on the handle or lever firmly engages the latch collar. If necessary, re-adjust latch collar position. Tighten the clamping screw to hold the collar in place.

Step 3. Verify the correct motor rests are used. (Part numbers are molded on the motor rests)

2303933 motor rest – right 4" motor assemblies
2303938 motor rest – left 4" motor assemblies

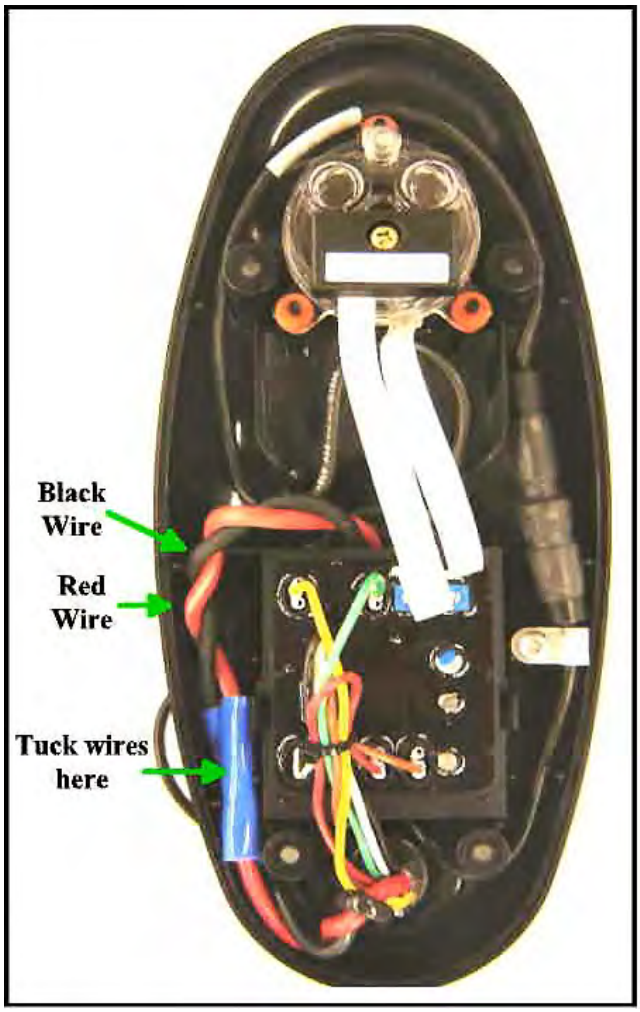
2303932 motor rest – right 3-5/8" motor assemblies
2303937 motor rest – left 3-5/8" motor assemblies

2303930 motor rest – right 3-¼" motor assemblies
2303935 motor rest – left 3-¼" motor assemblies

Step 4. Replace the pivot pads (P/N 2305103).

Effects of Broken or Intermittent Wires in Coil Cords

- If either the **yellow** or **green** coil cord wires are broken or intermittent, the **steering with the foot pedal will not function or will be intermittent**. AP function will not be affected in any way (the AP light will be lit when AP is turned on and the motor will track and hold a heading in the normal AP manner).
- If the **brown** wire in the coil cord is broken or intermittent, the **AP will not function**. If the AP function was turned on, it will turn off and the AP indicator will not be lit. **Steering with the foot pedal will be clockwise only**, regardless if either the left or right side of the steering pedal is pressed.
- If either the **white** or small **black** coil cord wires are broken or intermittent, **the steering function will be inoperative or intermittent**. The motor will not respond to the foot pedal, and the AP will not track a heading even though the AP indicator light is lit.
- If the small **red** coil cord wire is broken or intermittent, **the foot pedal steering will be inoperative or intermittent**. If the AP function was turned on, it will turn off and the AP indicator light will not be lit, and **the AP system will not function**.



AutoPilot Calibration (PD/AP models 2001 models and newer)

Step 1: Cut out AP-template and tape to a piece of cardboard.

Step 2: Use an amp meter to measure the current draw through the battery lead wires of the trolling motor.

Step 3: Place stall clamp on prop.

Step 4: Rotate motor so the prop is facing to the west.

Step 5: Lay AP-template on top of the Drive Housing (see figure 2). Make a pencil mark on the depth collar; in line with the center mark of the AP-template.

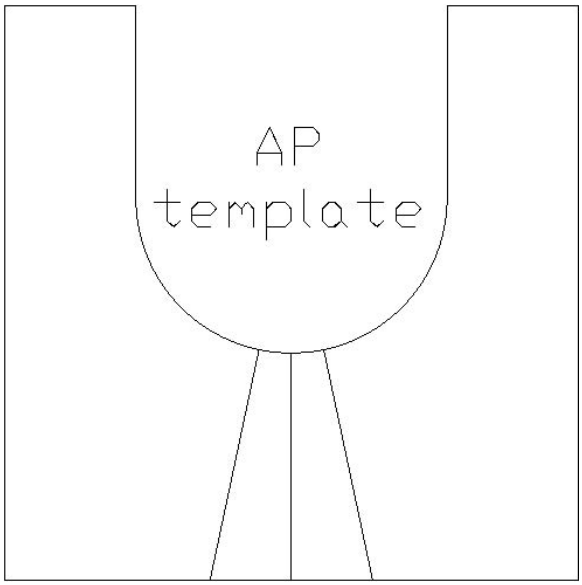
Figure 2

Step 6: Activate AutoPilot with button on control cover (during testing leave the control cover on, sunlight and other bright lights can affect the operation of the compass). While pressing down on the Momentary switch, slide the speed selector until an amp draw of at least 28 and no more than 38 amps has been obtained. Observe the movement of pencil mark. Ensure pencil mark stays within the range of the AP-template. Turn motor off. DO NOT STALL MOTOR FOR MORE THEN 15 SECONDS. If pencil mark does not stay within the required range, add 1-2 more twist to the main motor wires in the control head, re-test.

Step 7: Rotate motor so the prop is facing to the north. Repeat steps 5 and 6. If wire adjustments are required at this step, repeat steps 4, 5, 6, and 7 until steering is within spec. The pencil mark should stay within the template marks in both directions. The main motor wires may need to be moved closer to, or farther from the compass to fully eliminate the magnetic fields.

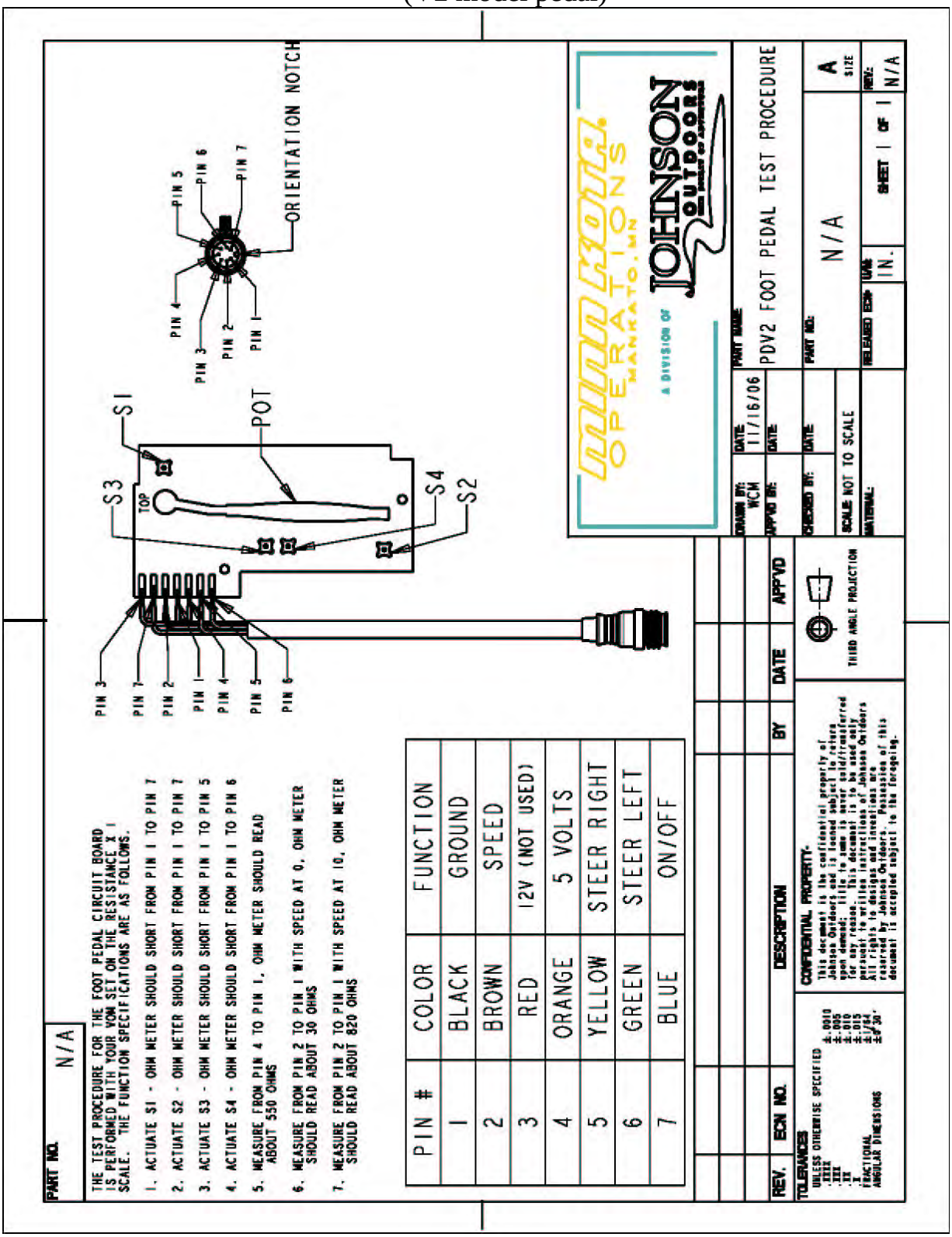
Step 8: Remove stall clamp.

BETTER UNDERSTANDING: As the motor is being stalled a magnetic field is being generated between the main motor wires. The more amperage that is drawn will lead to a larger magnetic field. This magnetic field causes a magnetic shift between “Magnetic North” and the compass magnet. With proper wire placement and twisting of the main motor wires around each other, the magnetic field is interrupted and cancels its effect on the compass magnet.



V2 Foot Pedal Test Procedure

(V2 model pedal)


PART NO. N/A
THE TEST PROCEDURE FOR THE FOOT PEDAL CIRCUIT BOARD IS PERFORMED WITH YOUR VOM SET ON THE RESISTANCE X 1 SCALE. THE FUNCTION SPECIFICATIONS ARE AS FOLLOWS.
1. ACTUATE S1 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 7
2. ACTUATE S2 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 7
3. ACTUATE S3 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 5
4. ACTUATE S4 - OHM METER SHOULD SHORT FROM PIN 1 TO PIN 6
5. MEASURE FROM PIN 4 TO PIN 1, OHM METER SHOULD READ ABOUT 550 OHMS
6. MEASURE FROM PIN 2 TO PIN 1 WITH SPEED AT 0, OHM METER SHOULD READ ABOUT 30 OHMS
7. MEASURE FROM PIN 2 TO PIN 1 WITH SPEED AT 10, OHM METER SHOULD READ ABOUT 820 OHMS
PIN # | COLOR | FUNCTION
1 | BLACK | GROUND
2 | BROWN | SPEED
3 | RED | 12V (NOT USED)
4 | ORANGE | 5 VOLTS
5 | YELLOW | STEER RIGHT
6 | GREEN | STEER LEFT
7 | BLUE | ON/OFF
PIN 3
PIN 7
PIN 2
PIN 1
PIN 4
PIN 5
PIN 6
S1
S3
S4
S2
POT
TOP
PIN 5
PIN 6
PIN 7
PIN 4
PIN 3
PIN 2
PIN 1
ORIENTATION NOTCH
JOHNSON OUTDOORS
A DIVISION OF
OPERATIONS
MANKATO, MN
DRAWN BY: WCM
DATE: 11/16/06
APPROVED BY:
DATE:
CHECKED BY:
DATE:
SCALE: NOT TO SCALE
MATERIAL:
PART NAME: PDV2 FOOT PEDAL TEST PROCEDURE
PART NO: N/A
RELEASED ECN#
UNIT: IN.
SHEET 1 OF 1
REV: N/A
A SIZE
REV. | ECN NO. | DESCRIPTION | BY | DATE | APP'VD
TOLERANCES
UNLESS OTHERWISE SPECIFIED
.XXX ±.010
.XX ±.005
.X ±.010
X ±.015
FRACTIONAL ±1/64
ANGULAR DIMENSIONS ±0°30'
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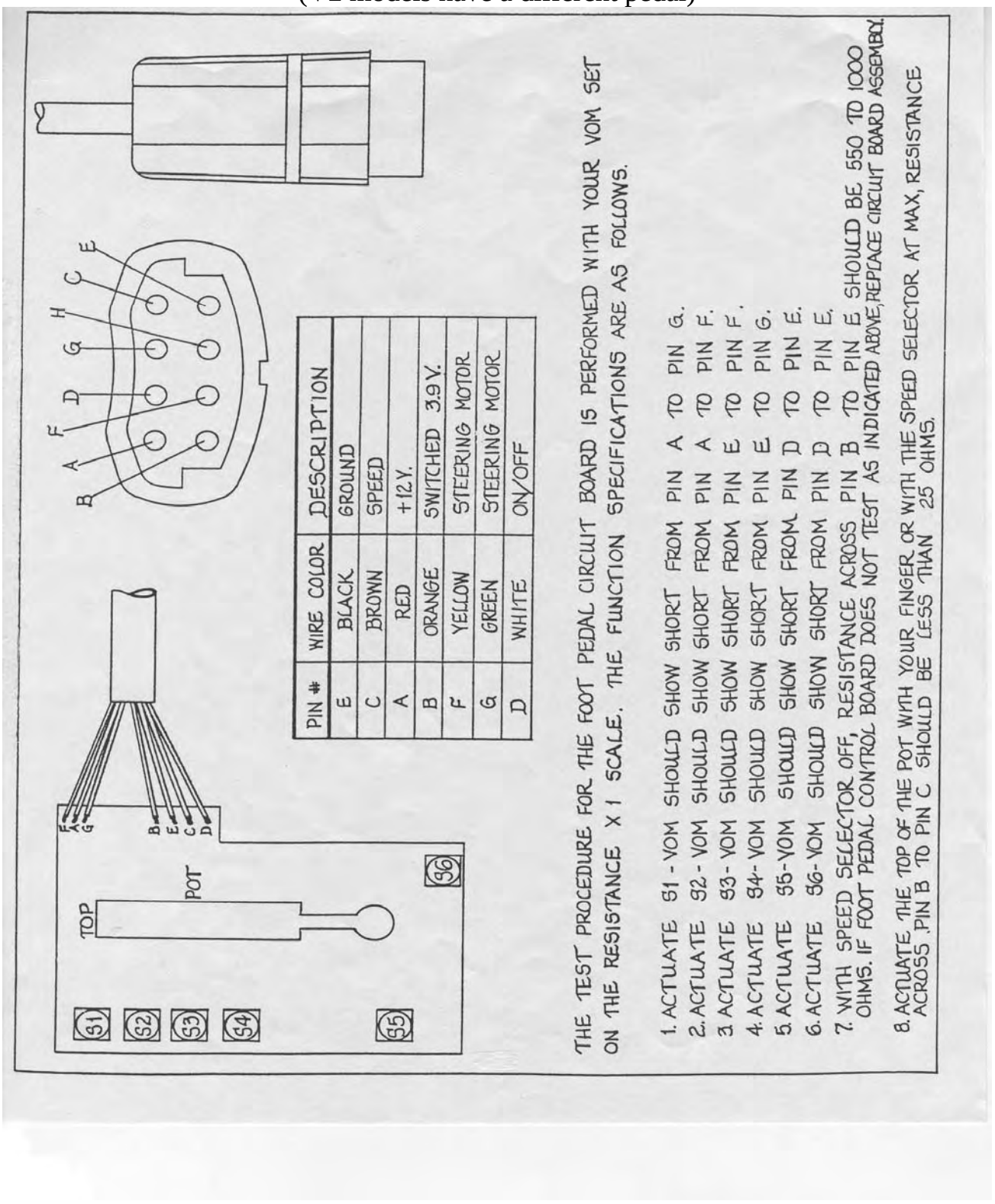
THIRD ANGLE PROJECTION

Corded Foot Pedal Test Procedure

(V2 models have a different pedal)



PIN #	WIRE COLOR	DESCRIPTION
E	BLACK	GROUND
C	BROWN	SPEED
A	RED	+12 V.
B	ORANGE	SWITCHED 3.9 V.
F	YELLOW	STEERING MOTOR
G	GREEN	STEERING MOTOR
D	WHITE	ON/OFF

THE TEST PROCEDURE FOR THE FOOT PEDAL CIRCUIT BOARD IS PERFORMED WITH YOUR VOM SET ON THE RESISTANCE X 1 SCALE. THE FUNCTION SPECIFICATIONS ARE AS FOLLOWS.

1. ACTUATE S1 - VOM SHOULD SHOW SHORT FROM PIN A TO PIN G.
2. ACTUATE S2 - VOM SHOULD SHOW SHORT FROM PIN A TO PIN F.
3. ACTUATE S3 - VOM SHOULD SHOW SHORT FROM PIN E TO PIN F.
4. ACTUATE S4 - VOM SHOULD SHOW SHORT FROM PIN E TO PIN G.
5. ACTUATE S5 - VOM SHOULD SHOW SHORT FROM PIN D TO PIN E.
6. ACTUATE S6 - VOM SHOULD SHOW SHORT FROM PIN D TO PIN E.
7. WITH SPEED SELECTOR OFF, RESISTANCE ACROSS PIN B TO PIN E SHOULD BE 550 TO 1000 OHMS. IF FOOT PEDAL CONTROL BOARD DOES NOT TEST AS INDICATED ABOVE, REPLACE CIRCUIT BOARD ASSEMBLY.
8. ACTUATE THE TOP OF THE POT WITH YOUR FINGER OR WITH THE SPEED SELECTOR AT MAX, RESISTANCE ACROSS PIN B TO PIN C SHOULD BE LESS THAN 25 OHMS.

PART II.

Motors manufactured PRIOR to model year 2001 (prior to s/n AB).

PART II - Case I. Drive Housing will not steer in one or both directions (in manual mode).

Step 1. Check to ensure proper voltage and polarity at battery. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security. Visually check to see that all wires are attached to proper control board terminals. Consult the appropriate wiring diagram for the model and board being tested. Clean / rewire, if necessary.

Step 2. Check motor with known good test foot pedal or test the original pedal by performing *Foot Pedal PCB Test Procedure* on page 9-7.

- **A.** If test pedal properly steers motor or if the original pedal tests faulty as outlined on page 9-7, the original foot pedal is defective. Disassemble defective pedal to inspect if actuators are properly making contact on foot pedal board. Visually inspect foot pedal board for collapsed or burnt dome switches. Replace foot pedal, if necessary.
- **B.** If test pedal does not properly steer motor or if the original pedal tests okay as outlined on page 9-7, then test steering output of main control board. Use a test light (or V.O.M. probes) connected to the main control steering output terminals (consult appropriate wiring diagram). Connect known good foot pedal to main control board. Connect battery leads to proper voltage. If there is no board steering output as you try to steer left or right, then the main control board is defective and needs to be replaced.
- **C.** If main PCB has output voltage, drive housing is faulty. Test drive housing by connecting 12-volt power source directly to drive housing leads. If drive housing does not steer, open drive housing and inspect servo motor, drive gears, and sleeve bushings, for binding/lack of lubrication or water damage. Repair or replace the drive housing, as necessary.

PART II - Case II. Drive Housing steers in one direction only (AutoPilot or manual mode).

Step 1. Test drive housing by applying 12 volts to drive housing leads. Reverse polarity to verify drive housing does steer in both directions.

Step 2. Check for a short between either of the drive housing wires and the metal portion of the drive housing itself. To do this, use a V.O.M. to check for continuity between the drive housing lead and a screw on the underside of the drive housing.

- **A.** If a short is found, disassemble the drive housing and insulate the wire terminals at the drive housing's servo motor to correct the shorted condition. Reassemble the drive housing and again check for shorts.
- **B.** If no shorts are found, proceed to **Step 3**.

Step 3. The steering logic portion of the main control board is faulty. Replace main control board.

PART II - Case III. Drive Housing steers with foot pedal, but will not steer in AutoPilot mode.

Step 1. Check continuity of brown, yellow, blue, orange, and white wires in the coil cord with the coil cord stretched out to length. If you find a break in continuity in any of these wires, the coil cord is defective. Replace coil cord, if required.

Step 2. If no break in the continuity of the coil cord, perform the *Control Board /Compass Isolation Test* following the procedure provided with the *AutoPilot Test Board - Minn Kota P/N 20* (see page 9-11).

- **A.** If above test indicates sensor board compass assembly is defective, the replace compass assembly.
- **B.** If above test indicates main control board is defective, check functionality of AutoPilot ON/OFF switch (check for continuity through switch when ON and no continuity with switch OFF). Replace ON/OFF switch if defective, otherwise replace main control board.

PART II - Case IV. AutoPilot changes directions with speed changes.

Step 1. Small direction changes with speed changes are normal.

Step 2. If direction changes are more than 4 to 5 degrees, perform the *AutoPilot Calibration Procedure* (see page 9-12).

PART II - Case V. Motor won't steer or steers slowly at higher thrust settings.

Step 1. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in the battery leadwire for corrosion and security.

Step 2. Check to insure that wire of adequate gauge has been used in the boat's trolling motor circuit. (Wiring of inadequate gauge will result in a voltage drop to the motor and steering circuit at higher thrust settings. If, after insuring that all wiring and connections are good, the steering is still slow at high thrust settings, proceed to **Step 3**.

Step 3. Disassemble motor to separate the drive housing from the motor and tube and bowplate/extrusion assembly.

- **A.** Remove the six screws holding the top and bottom halves of the drive housing together. (Note: the top and bottom halves of the drive housing are "pinned" together at the corners with roll pins. The two halves will need to be pried apart.)
- **B.** Inspect the drive housing motor, paying special attention to the drive housing motor armature shaft and motor bushings. Test run to verify proper high speed operation and RPM.
- **C.** Remove the drive housing sleeve and bushings. Thoroughly clean the bushing and sleeve contact surfaces of all residue and old lubricant. Re-lubricate the bushing and sleeve contact surfaces with Bel-Ray Termalene #699 grease (Minn Kota p/n 2307720). Reassemble the drive housing taking special care to properly realign the drive housing pins, shafts, motor, and gears. Prior to installing and tightening the six drive housing case screws, test run the drive housing by applying 12 volts directly to the drive housing wire leads. If the drive housing motor runs properly, then make sure there are no gaps between the case halves (a rubber mallet works well to seat the case halves flush/tight). Install and tighten case screws.
- **D.** Reassemble the drive housing to the bow plate/extrusion assembly. Slide the motor and tube through the drive housing. Reconnect all wires in the control box and recalibrate AutoPilot compass (see page 9-12). Test for proper operation.

PART II - Case VI. AutoPilot function is erratic and doesn't maintain a heading.

Step 1. Make sure motor is mounted within 5 degrees of level and there is no ferrous metal object(s) near the motor that may be affecting the compass (including screws and/or nuts).

Step 2. Check motor for excessive vibration. Inspect propeller and propeller shaft for damage. (Excessive vibration can cause the AutoPilot compass to oscillate causing erratic operation.)

Step 3. Check for proper voltage to motor <u>while motor is under load</u>. AutoPilot steering is susceptible to erratic operation in low voltage situations. (Use of inadequate gauge wire in boat or any leadwire extension can result in voltage drop / low voltage to the motor; as can an inadequate or corroded plug / plug receptacle.)

Step 4. Check continuity of brown, yellow, blue, orange, and white wires in the coil cord with the coil cord stretched out to length. If you find a break in continuity in any of these wires, the coil cord is defective. Replace coil cord, if required.

Step 5. Check AutoPilot compass control board for proper voltage levels at the optical sensor circuit. (See Minn Kota Service Repair Bulletin #SB122099, *AutoPilot Compass Control Board Trim Pot Adjustment Procedure* – page 9-13.)

Step 6. Perform the *Control Board / Compass Isolation Test* following the procedure provided with the *AutoPilot Test Board – Minn Kota P/N 20* (see page 9-11). If operation is restored replace the sensor board compass assembly. If it isn't restored, replace the main control board.

PART II - Case VII. Motor (lower unit) fails to run or runs intermittently.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for corroded connections. Clean/rewire properly, if necessary.

Step 2. Check motor with known good test foot pedal or test the foot pedal by performing the *Foot Pedal Test Procedure* found on page 9-7.

- **A.** If test pedal properly controls all motor functions or if the original foot pedal tests bad as outlined on page 9-7, the original foot pedal is faulty. Replace foot pedal.
- **B.** If motor lower unit does not run properly with test pedal or if the original pedal tests okay as outlined on page 9-7, go to **Step 3**.

Step 3. Check to see if lower unit runs properly.

- **A.** Connect 12 volts directly to the red and black brush leads at the top of the motor shaft (in the control box). The motor should run. If not, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as necessary. If the motor operates properly, proceed to **Step 4**.

Step 4. If **Steps 1**, **2**, and **3** test okay, the main control board is faulty and needs to be replaced.

PART II - Case VIII. All functions dead.

Step 1. Check for proper battery voltage and polarity *at the control board input terminals.* Visually check for poor or corroded connections. Check for proper wiring of control board (consult appropriate wiring diagram).

Step 2. Defective control board. Replace main control board.

PART II - Case IX. Foot pedal sticks right/left when steering.

Step 1. Inspect actuators on underside of foot pedal for sand/dirt/grit.

- **A.** Disassemble and clean contaminated actuators. Replace components, if required.
- **B.** Reassemble foot pedal, leave actuators dry or use a dry lubricant to avoid further contamination with sand/dirt/grit.

PART II - Case X. MOM/CON switch lever will not stay down in CON position.

Step 1. From the underside of the footpedal, remove the 3 screws holding the slide control and switch lever in place.

- **A.** Remove screw holding the white plastic continuous actuator in place.
- **B.** Place shim (P/N 2301731) between actuator and pedal base.
- **C.** Reassemble slide-control and MOM/CON switch assembly. Test for proper operation.

PART II - Case XI. Motor is loose in the cradle.

Step 1. Check / replace the pivot pads (P/N 2305101), as needed. The pads tend to flatten or soften over time.

AutoPilot Control Board / Sensor Board Isolation Test

(MOTORS PRIOR TO 2001 MODELS ONLY)

The AutoPilot test board is to be used to trouble shoot an AutoPilot that is not "locking" on a heading, or is failing to properly respond when in the AutoPilot mode.

Step 1. Use the AutoPilot test board (P/N 20) provided through the Minn Kota parts department.

Step 2. Remove the control box cover.

Step 3. Disconnect the 5 wires from the coil cord to the sensor board.

Step 4. Connect the 5 wires to the Test Board and turn Switch B to Position 1.

Step 5. Turn the AutoPilot "ON/OFF" switch ON, and wait 2 seconds.

Step 6. Flip Switch A to Position 1, and then Position 2. Steering motor should pulse both clockwise and counter clockwise. Steering should stop at center position of Switch A.

Step 7. If no steering is observed in **Step 6**, check continuity of brown, yellow, blue, orange, and white wires in the coil cord with the coil cord stretched out to length. If continuity is not observed through each wire, replace coil cord. If there is continuity through each wire, the main control board is defective and needs to be replaced.

Step 8. Turn AutoPilot ON/OFF switch OFF.

Step 9. Turn Switch B to Position 2.

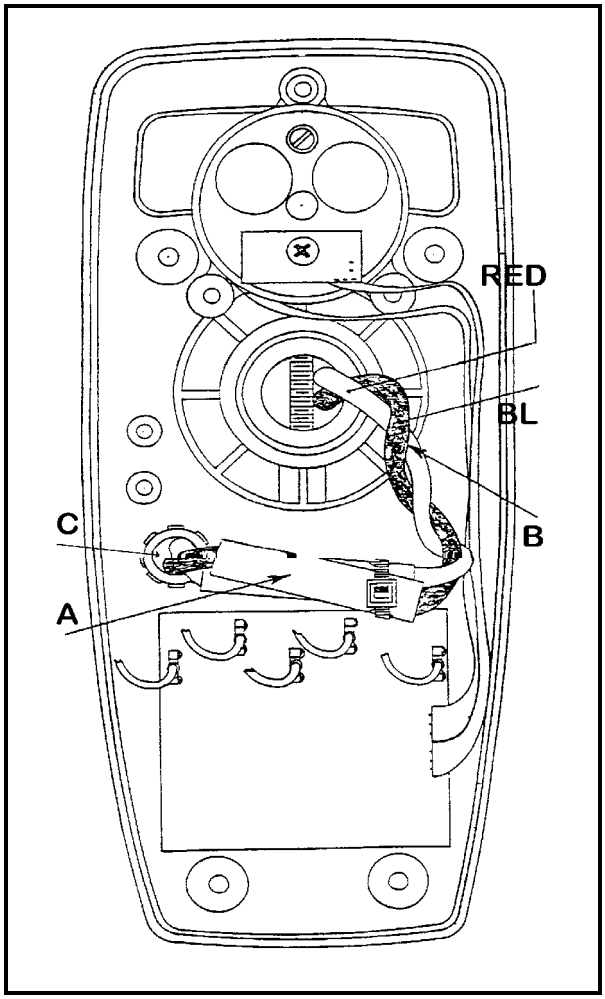
Step 10. Turn the AutoPilot ON/OFF switch ON, and wait 2 seconds.

Step 11. Flip Switch A to Position 1, and then Position 2. Steering motor should pulse clockwise and counter clockwise. Steering should stop at center position of Switch A.

Step 12. If **Steps 6, 7**, and **11** work without fault, the main control board is functioning properly, and the compass sensor board assembly in the control head should be replaced.

AutoPilot Calibration

(PRIOR TO 2001 MODELS ONLY)



Step 1. Place stall clamp on motor.

Step 2. Face the control head west.

Step 3. Turn foot pedal CON (constant) switch ON, advance speed selector between speed 4 - 5. Watch the compass disc for movement. Movement can be minimized by changing cross over point (**B**) up or down (gradually tighten tie wrap as you calibrate). If the compass disc moves clockwise, the cross-over point must be moved up. You may find it helpful using a pair of brass needle-nose pliers for these adjustments.

Step 4. Point the motor control head north. Repeat the stall test while watching the compass disc (usually very little adjustment is needed at this point). If necessary, adjust while gradually tightening tie wrap. If excessive movement is noticed, rotate the coil cord in area (**C**) the same direction as the movement to minimize magnetic interference from the coil cord. Re-check in west direction after this adjustment.

Step 5. Rotate motor to original position. Clip end of cable tie.

Step 6. Remove stall clamp from motor.

Step 7. Re-check AutoPilot function as directed in previous position.

Step 8. Apply hot glue around pig-ring and attach control box cover.

When rechecking AutoPilot function, assure motor finds it direction and doesn't over-steer. If necessary, recalibrate compass.

AutoPilot Compass Control Board Trim Pot Adjustment Procedure

(MOTORS PRIOR TO 2001 MODELS ONLY)

Note: You *must* use a non-magnetic screwdriver and a good quality digital V.O.M. in order to properly perform this procedure. Use a V.O.M. with a sharp probe on the red V.O.M. lead, as you will need to pierce through the humiseal coating on the compass control board to obtain accurate voltage readings. In addition, the compass must be in a level position and away from any ferrous metal/steel objects or strong magnetic fields. A small fixture such as the one shown in the accompanying diagrams will allow you to perform these adjustments on your bench top or, if you wish, the compass control board can be left in the motor control box. Be sure to follow the wiring connections as outlined and shown in this procedure.

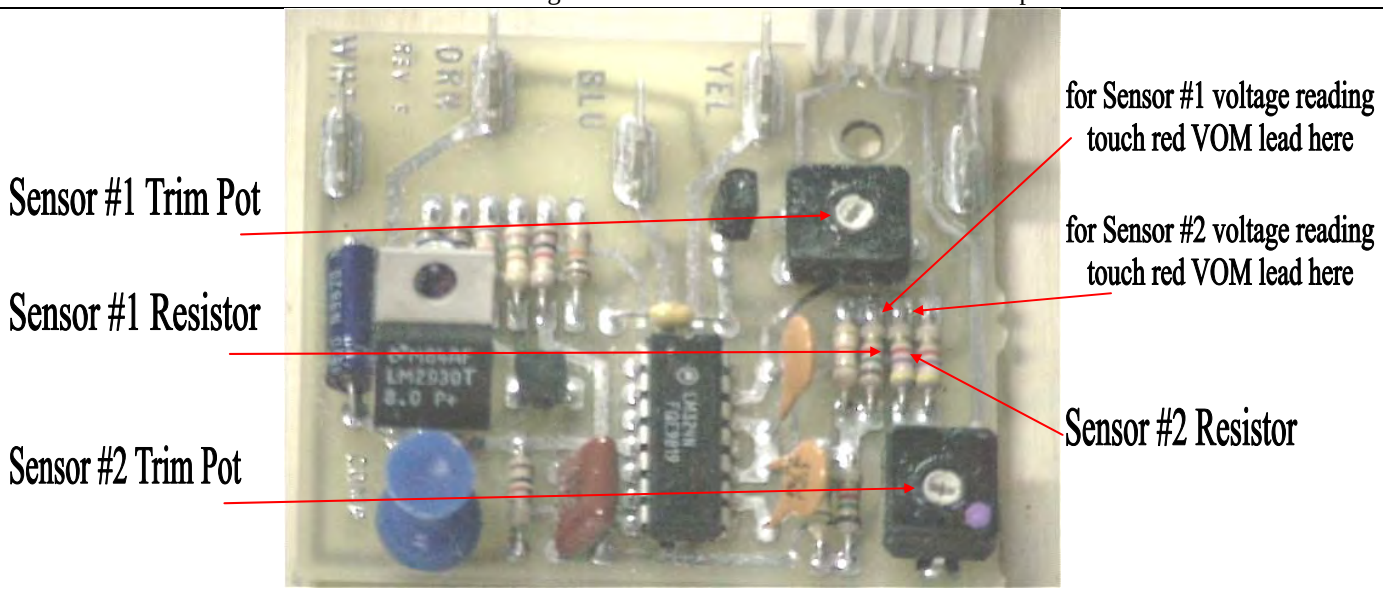

Sensor #1 Trim Pot
Sensor #1 Resistor
Sensor #2 Trim Pot
for Sensor #1 voltage reading touch red VOM lead here
for Sensor #2 voltage reading touch red VOM lead here
Sensor #2 Resistor

diagram 1

Step 1. Test/adjust the sensor #1 voltage ***(see diagram 1 for component location)***

- **A.** Tightly cover the compass card with a shop rag to block any light source on the optical sensors.
- **B.** With the compass level and pointed **southeast**, connect 12 volts to the orange (+12v) and brown (ground) terminals. *(see diagram 2)*
- **C.** With your digital V.O.M. set to check DC voltage, connect the black V.O.M. lead to the brown (ground) terminal on the compass control board and firmly touch the red probe of the V.O.M. lead to the sensor #1 resistor *(as shown in diagram 2).*
- **D.** Observe the voltage displayed on the V.O.M. while slightly turning the compass a few degrees each side of the original southeast heading.
- **E.** Position the compass so that the lowest voltage is displayed on the digital V.O.M.. If this voltage is 1 volt (± .25v) no further adjustment is needed, and go to **Step 2**. If the voltage needs adjustment, proceed to **Step 1F**.
- **F.** Using a small non-magnetic blade screwdriver, adjust trim pot #1 so that the voltage displayed on the V.O.M. is as close as possible to 1 volt (± .25v). (Compass is defective if you cannot reach this tolerance.)

Step 2. Test/adjust the sensor #2 voltage ***(see above diagram 1 for component location)***

- **A.** Tightly cover the compass card with a shop rag to block any light source on the optical sensors.
- **B.** With the compass level and pointed **southwest**, connect 12 volts to the orange (+12v) and brown (ground) terminals.
- **C.** With the digital V.O.M. set to check DC voltage, connect the black V.O.M. lead to the brown (ground) terminal and touch the red probe of the V.O.M. lead to the sensor #2 resistor. *(as shown in diagram 3)*
- **D.** Observe the voltage displayed on the V.O.M. while slightly turning the compass a few degrees each side of the original southwest heading.
- **E.** Position the compass so that the lowest voltage is displayed on the digital V.O.M.. If this voltage is 1 volt (± .25v) no further adjustment is needed. If the voltage needs adjustment, proceed to **Step 2F**.
- **F.** Using a small non-magnetic blade screwdriver, adjust trim pot #2 so that the voltage displayed on the V.O.M. is as close as possible to 1 volt (± .25v). (Compass is defective if you cannot reach this tolerance.)

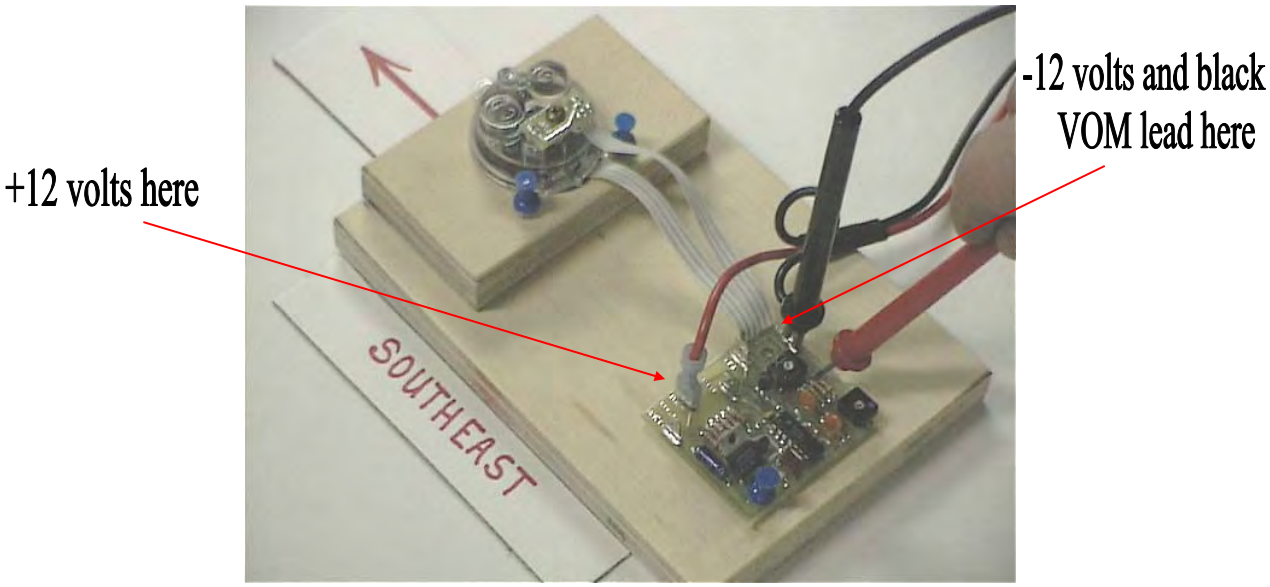


diagram 2

NOTE: Compass removed from motor and compass card not covered for clarity. Compass card should be covered to block any light on the optical sensors!

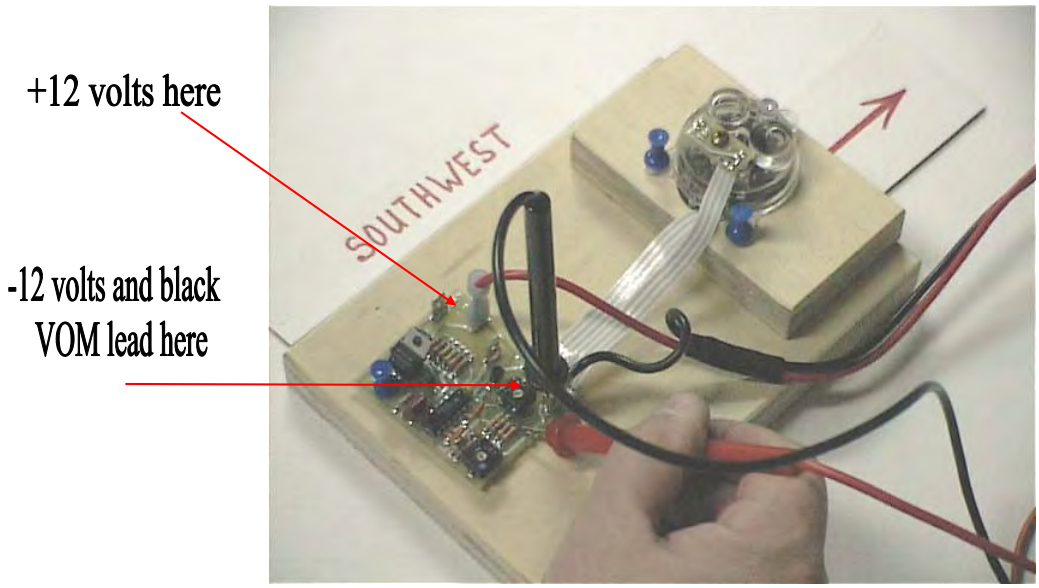


diagram 3

NOTE: Compass removed from motor and compass card not covered for clarity. Compass card should be covered to block any light on the optical sensors!

This concludes the trim pot adjustment procedure. A small drop of RTV rubber silicone (non-acidic based) sealant over the trim pots will ensure they will not change due to vibration or extreme heat fluctuation. The properly adjusted compass control board is now ready to be reinstalled (if necessary) and the motor put back into use.

Chapter 10.

Manufactured between 1996-1999

Cordless PowerDrive and AutoPilot Models

(This does not pertain to CoPilot! PD/C and PD/AP/C were series of motors in the late 1990's.)

Case I. Motor fails to operate

Step 1. Ensure proper initialization:

A. Connect motor leadwires to proper voltage and correct polarity.

B. Check battery leadwire connections, trolling motor plug (if one is installed), all butt splice connections, and leadwire connections at main printed circuit board.

C. Turn on receiver sideplate (motor ON/OFF switch) first, then turn on the foot pedal transmitter ON/OFF switch, then send a signal with the foot pedal transmitter.

Step 2. Check receiver sideplate LED operation. Upon initialization (first command to receiver) the receiver sideplate LED should light. It will stay on for approximately five minutes, even if no further commands are received. LED should flash when steering and also flash briefly as speed is changed.

A. If LED operates OK, then the radio portion of the circuit (transmitter/receiver) is operating correctly. Diagnose motor per corded model instructions.

OR

***AutoPilot models:** Use test foot pedal adapter and corded test foot pedal (see page 10-3).

NOTE: when using test pedal adapter, the "MOM/CON" lever of the corded test foot pedal must be in the "CON" position and the motor ON/OFF switch must be ON. If motor operates correctly with this test procedure, problem lies in the software (transmitter or receiver i.e. cordless pedal or sideplate). If motor does not operate properly with this test procedure, diagnose motor per corded model instructions.

***Non-AutoPilot models:** Non-AutoPilot models can be tested with a corded foot pedal (do NOT use the corded-adapter). As with the AutoPilot models, the motor ON/OFF switch must be ON in order to properly test all motor functions.

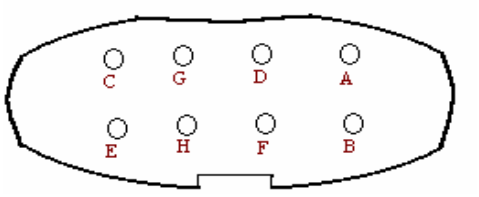
B. If LED does not come on when initialized:

B-1. Verify proper battery voltage to trolling motor (12v or 24v)

B-2. Make sure that "motor on/off" switch on motor is ON before foot pedal ON/OFF switch is turned ON.

B-3. Verify transmitter battery condition. Signal strength decreases as the AA batteries in the foot pedal get weaker. Using a V.O.M. check for voltage across the red and black wires of the foot pedal battery holder (with 4 good AA batteries you should see about 6 volts). Check AA battery contacts. Replace bad batteries, as necessary.

B-4. If batteries and connections in the foot pedal check out okay, test receiver sideplate / motor ON/OFF switch to insure that the switch is functional. This can be accomplished by testing across the switch leads with a V.O.M. for continuity, or by testing across pins "A" and "E" for voltage with the ON/OFF switch turned ON.



Plug end from main control board

B-5. If no voltage or continuity is noted, inspect the receiver sideplate / motor ON/OFF switch and replace with switch kit p/n 2880230, if necessary.

B-6. Initialize and test for motor operation with new switch to verify function.

Case II. Motor operates fine, but while in use, shuts down and requires re-initialization.

Step 1. Check all battery connections, trolling motor leadwire plug and plug receptacle connections (if plug has been installed), all butt splice connections, leadwire connections at main control board, and any circuit breakers that may be installed in the boats trolling motor electrical system.

A. Malfunctions of this nature are almost always due to a momentary interruption in power to the trolling motor and RF/receiver sideplate.

B. Correct any faulty wiring connections, re-initialize, and test motor under load.

Case III. AutoPilot of cordless motor fails to operate.

Step 1. Consult *Chapter 9 AutoPilot Model: Part II - CaseVI.* on page 9-9 for troubleshooting steps and compass isolation test.

NOTE: motor must be initialized properly first. Be sure both switches are turned ON. The RF/motor switch is the switch with the wires that run closer to the heat transfer bar.

Case IV. Over-steer

Step 1. Check for "old" software. (see Software for Cordless Motors below)

Case V. Delay in speed function (prop).

Step 1. Check for "old" software. (See Software for Cordless Motors below)

Software for Cordless Motors

Model	Receiver	Foot Pedal***
36 PD/C & 42PD/C	2303927*	2774708*
36PD/AP/C & 42PD/AP/C	2303926**	2774708**
48PD/AP/C	2303926	2774708
MKA-9	2303925	2774708
RT42AP/C	2303926	2774709
RT48AP/C	2303926	2774709

* early units were shipped with 2303923 receiver and 2994705 foot pedal

** early units were shipped with 2303924 receiver and 2994705 foot pedal

*** the 2774708 (new) foot pedal has a black label with white letters on the bottom of the pedal versus the 2774705 (old) pedal which had a white label with black lettering

Case VI. Foot pedal sticks right/left when steering.

Step 1. Inspect actuators on underside of foot pedal for sand/dirt/grit.

A. Disassemble and clean contaminated actuators, inspect for repair and replace components if required.

B. Reassemble foot pedal, leave actuators dry or use a dry lubricant to avoid further contamination with sand/dirt/grit.

C. NOTE: If foot pedal sticks while customer is fishing, he may simply swish the foot pedal in the water to temporarily flush the sand/dirt/grit from the actuator surfaces.

Case IV. MOM/CON switch lever will not stay down in CON position.

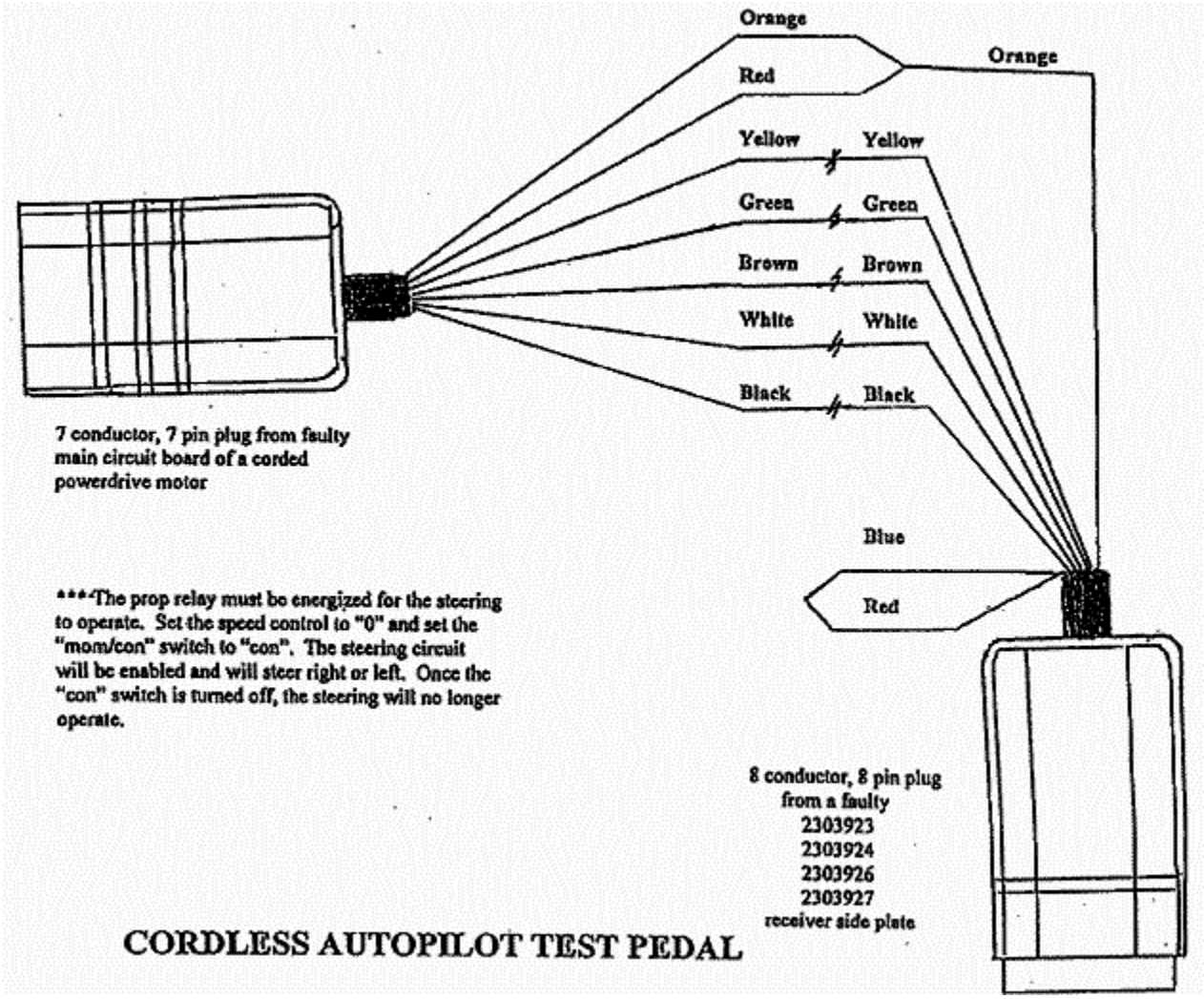
Step 1. From the underside of the footpedal, remove the 3 screws holding the slide control and switch lever in place.

A. Remove screw holding the white plastic continuous actuator in place.

B. Place shim (P/N 2301731) between actuator and foot pedal base.

C. Reassemble slide control MOM/CON switch assembly and test for proper operation.

Cordless AutoPilot Test Pedal


Orange
Red
Orange
Yellow
Yellow
Green
Green
Brown
Brown
White
White
Black
Black
7 conductor, 7 pin plug from faulty main circuit board of a corded powerdrive motor
Blue
Red
***The prop relay must be energized for the steering to operate. Set the speed control to "0" and set the "mom/con" switch to "con". The steering circuit will be enabled and will steer right or left. Once the "con" switch is turned off, the steering will no longer operate.
8 conductor, 8 pin plug from a faulty
2303923
2303924
2303926
2303927
receiver side plate
CORDLESS AUTOPILOT TEST PEDAL

Chapter 11.

Terrova Models

All Terrova motors rely on a microprocessor based network serving as the communication link between the main control board and network accessories such as the foot pedal, AutoPilot compass control board, and CoPilot receiver board (if the motor is so equipped). Any failure in this communication link can cause problems for the Terrova motor. Upon motor deployment, (with appropriate voltage and polarity applied to the motor battery leads), the green *System Ready* LED will illuminate. At this time, the microprocessor on the main control board checks for any network accessories (foot pedal, AutoPilot, or CoPilot) that could be connected to the main control board. If the microprocessor on the main board is getting an incorrect reading at this time, or if the AutoPilot or CoPilot network accessory is not properly connected, the microprocessor will not "recognize" the accessory and that accessory function will not be enabled. A faulty network accessory can also cause Terrova motor malfunctions due to network interference. When servicing Terrova motors (disassembling/removing/adding network accessories) power to the motor should be disconnected and/or the motor should be stowed (green system ready LED not lit).

We recommend having a known good foot pedal and Terrova CoPilot transmitter to aid in troubleshooting.

Case I . Motor is non-functional / all functions dead.

Step 1. The motor must be in the deployed position for motor to function. The Terrova motor is equipped with a green *system ready* LED indicator that should only be on when the motor is deployed. When the motor is properly stowed this system ready light will be off indicating that the motor is not ready for use and is not operable.

Step 2. Check to ensure proper voltage and polarity at battery. Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery leadwire for corrosion and security. Visually check to see that all wires are attached proper control board terminals. Consult the appropriate wiring diagram for the model and board being tested. Clean / rewire, if necessary.

Step 3. See **Case X** on page 11-6 for information on Control Board Replacement.

Case II. System Ready LED is on when the motor is stowed.

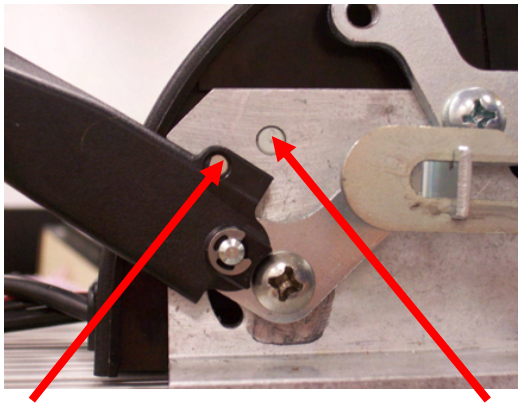
Step 1. Ensure the release handle is fully latched and locked into the stowed position.

Step 2. Check to ensure the system ready reed switch (small plastic cylinder with two wires going to control board) is positioned in the side of the base extrusion. (Remove the right sideplate for viewing.) **(see Picture 1, page 11-2)**

Step 3. Inspect the release handle cover, p/n 2320215, for the presence of the magnet. Replace handle cover if magnet is missing.

Step 4. If the reed switch and magnet are in place, but system ready LED remains lit when the motor is stowed, the reed switch is faulty, replace main control board. See **Case X** on page 11-6 for information on Control Board Replacement.

Picture 1



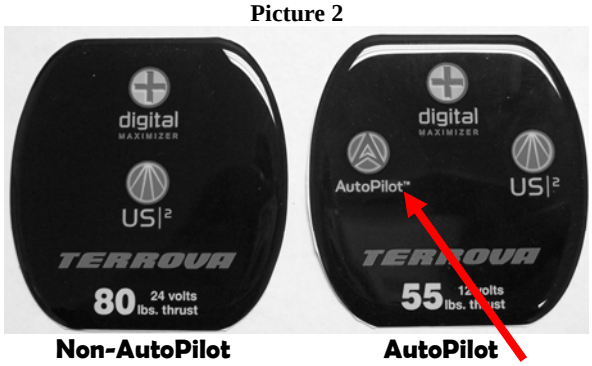
This illustration shows the magnet in the handle cover and the system ready reed switch located in the extrusion.
When the handle is in the "deployed" position (magnet away from reed switch) the system ready light will be on.

Case III. AutoPilot is nonfunctional.

Step 1. Determine if the motor is AutoPilot equipped. Not all Terrova motors are AutoPilot models, but all Terrova motors (whether they have AutoPilot or not) share the same foot pedal, CoPilot remote, and main control boards (12-v or 24/36-v). This means that all Terrova motors have an AutoPilot button on the foot pedal and CoPilot remote, as well as an AutoPilot red LED on the motor base, but unless it has the AutoPilot compass control board (network accessory) installed in the control box at the top of the shaft it is not AutoPilot equipped.

A. All Terrova motors that leave the factory with the AutoPilot feature installed will indicate this on the control box cover decal. **(see Picture 2)**

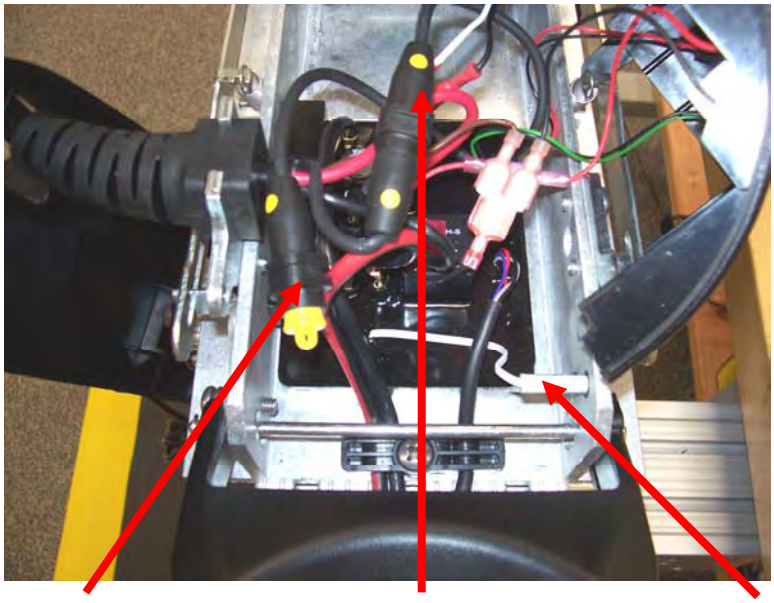
Picture 2



B. Because all Terrova motors are AutoPilot capable (with the addition of the AutoPilot compass control board to the network), a Terrova motor that originally left the factory as a non-AutoPilot model can be converted to AutoPilot at a later date. (AutoPilot accessory is being sold as an "upgrade kit" beginning in 2008.) A Terrova motor converted to AutoPilot would not have the AutoPilot icon on the cover decal. To determine if the motor is AutoPilot equipped, remove the control box cover to see if an AutoPilot compass control board is installed.

Step 2. If it was determined in **Step 1A** or **1B** that the motor is AutoPilot equipped check to ensure that the network accessory plugs for the AutoPilot compass control board (in the control box at the top of the motor shaft) and at the main control board (on the motor base plate) are clean, show no signs of corrosion, have no bent pins, and are fully engaged and properly seated together. **(see Pictures 3 & 4, page 11-3)**

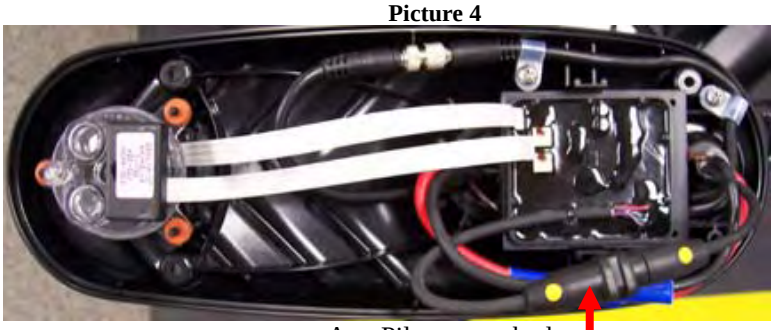
Picture 3



not being used connected to AutoPilot network plug system ready reed switch

This picture is showing the 2 network cables coming off control board. In this case, one is connected to the compass board network plug and the other is not being used. (No CoPilot attached, so yellow cap still on plug.)
NOTE: network plug leads from the main control board are common, either lead can be connected to either accessory.

Picture 4



AutoPilot network plug

This picture is showing the control box with AutoPilot Compass Control board and network cable plugs.

Step 3. Reconnect motor to power and/or deploy motor to turn on the system ready LED (this allows the main board microprocessor to "recognize" the AutoPilot network accessory. Check for AutoPilot function. If AutoPilot still fails to operate then replace the AutoPilot compass control board assembly.

Case IV. AutoPilot function is erratic and doesn't maintain a heading.

Step 1. Make sure motor is mounted within 5 degrees of level (the compass card with the graduated markings must be floating level) and there are no ferrous metal objects near the motor that may be affecting the compass (including screws/nuts). While maintaining a level compass, spin the control box and observe the compass card. The card should remain stationary (i.e. card should not have lost its system ready north reference) as the control box is turned. If the compass card sticks or "hangs up" it is faulty, and the compass assembly needs to be replaced.

- **A.** Inspect oil level in compass capsule looking for a leaky capsule. NOTE: Examine the red compass grommets. If the compass has leaked fluid the grommets will be swollen almost double their normal size.
- **B.** If any sign of compass fluid leakage is evident, replace the compass control board assembly.

Step 2. Check motor for excessive vibration. Inspect propeller and propeller shaft for damage. (Excessive vibration can cause the AutoPilot compass to oscillate causing erratic operation.)

Step 3. Check for proper voltage to motor <u>while motor is under load</u>. AutoPilot steering is susceptible to erratic operation in low voltage situations. (Use wire of adequate gauge in boat or for any leadwire extension to avoid voltage drop / low voltage to the motor. Also check for an inadequate or a corroded battery leadwire plug / plug receptacle.) Correct any low voltage issues and retest.

Step 4. If in previous steps no problems were noted, but AutoPilot still does not function properly then replace the compass control board assembly.

Case V. Motor steers properly, but motor lower unit does not run.

Step 1. Check for proper voltage and polarity *at the control board input terminals*. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for corroded connections. Clean/rewire properly, if necessary.

Step 2. Check motor with known good test foot pedal.

- **A.** If test pedal properly controls all motor functions the original foot pedal is faulty. Replace foot pedal.
- **B.** If motor lower unit does not run properly with test pedal proceed to **Step 3**.

Step 3. Check to see if lower unit runs properly.

- **A.** Connect 12 volts directly to the red and black brush leads at the top of the motor shaft (in the control box). The motor should run. If not, a problem exists in the lower unit. Check the lower unit for voltage at the brushes, water in the lower unit, worn brushes, or an open or shorted armature. Repair as necessary. If the motor operates properly, proceed to **Step 4**.

Step 4. If **Steps 1**, **2**, and **3** test okay, the main control board is faulty and needs to be replaced. See **Case X** on page 11-6, for information on Control Board Replacement.

Case VI. Terrova motor equipped with CoPilot, but CoPilot doesn't work.

Step 1. Remove right motor sideplate and inspect network connection from CoPilot receiver board to main control board. Check to ensure that the plug pins are not bent and that the plug connection is fully engaged and properly seated. NOTE: when fully engaged, no yellow space will be seen between the plug ends and the plug connection will "snap" twice as they are pushed together. Reconnect power to motor or deploy motor to turn on the system ready LED and enable the system. Test for motor function using CoPilot remote transmitter. If motor does not function proceed to **Step 2**.

Step 2. Test motor with known good corded foot pedal. If motor functions properly with test pedal, the CoPilot remote transmitter may be faulty. Disassemble the transmitter to check battery voltage (battery is 3-volt lithium coin cell). Replace battery if voltage is low. Inspect the gold plated switch contacts on the transmitter circuit board for corrosion. If any corrosion is noted, replace the transmitter. Clean the conductive rubber contacts on the transmitter switch pads with rubbing alcohol. Reassemble and retest.

- **A.** If motor still does not respond to the remote transmitter try "relearning" the receiver to the transmitter.
- **B.** If motor still does not respond, then reprogram/relearn the receiver to a known good remote transmitter.
- **C.** If the CoPilot responds properly, the customer's transmitter is faulty and needs to be replaced.
- **D.** If, after "learning" or programming the receiver to the "test" transmitter it still does not function, the CoPilot receiver board is faulty and needs to be replaced.

Case VII. Motor does not stow/latch properly.

Step 1. Lubricate the composite shaft with a silicone spray or Armor All®.

Step 2. Inspect release handle and handle follower pin. Remove the follower pin and inspect; if it is bent you should assume the handle is also bent. This condition is usually from forcing the handle down rather that pushing in and then down (or stepping on the release handle).

Step 3. Inspect the motor ramps. Move ramps through an arc between the stowed and deployed positions, watching for straight travel. Replace parts, as necessary.

Step 4. Check the release arms (both left and right) to ensure they are flat. They should run parallel with the base extrusion. Replace arms, if needed.

Case VIII. Terrova motor functions are intermittent / work erratically (sometimes they work and sometimes they don't).

Step 1. Check all network accessory plug connections (foot pedal, AutoPilot, and/or CoPilot – depending on how motor is equipped) for security and full engagement of the male/female plug ends. Examine the plug pins and sleeves. Pins should be straight and neither pins nor sleeves should show signs of corrosion. NOTE: be sure to disconnect power to motor (or stow motor to interrupt power) when disconnecting and reconnecting network accessory plugs. Reconnect power (or deploy motor) after connecting, or changing network accessories.

Step 2. Test network accessories one at a time to determine which component may be faulty.

- **A.** Disconnect power to motor (or stow motor to disable / turn off the system ready LED). Disconnect the network accessories from the main control board (foot pedal, AutoPilot, and CoPilot – if motor is so equipped). **(see Picture 3, page 11-3)** Connect known good (test) foot pedal and reconnect power or deploy motor to enable / turn on the system ready LED. Test for proper operation.
  - **A-1.** If motor fails to function properly, main control board is faulty and needs to be replaced. (See **Case X** on page 11-6 for information regarding main board replacement.)
  - **A-2.** If motor works properly with test pedal, proceed to **Step 2B**.
- **B.** Disconnect power to motor or stow motor to disable / turn off the system ready LED. Disconnect test pedal and connect customer's pedal to motor. Reconnect power or deploy motor and retest for proper operation.
  - **B-1.** If motor now malfunctions with customer foot pedal, pedal is faulty and needs to be replaced.
  - **B-2.** If motor functions check okay, suspect a faulty network accessory (AutoPilot or CoPilot depending on how motor is equipped.) Proceed to **Step 2C**.
- **C.** Disconnect power to motor or stow motor to disable / turn off the system ready LED. If the motor is AutoPilot equipped (see **Case III** on page 11-2 to determine or confirm that motor is AutoPilot equipped), connect the AutoPilot network accessory plug to the network plug from the main control board. (NOTE: network plug leads from the main control board are common / either lead can be connected to AP or CoPilot accessory.) Reconnect power or deploy motor to enable / turn on the system ready LED and test motor for proper operation.
  - **C-1.** If motor AutoPilot functions do not operate, go to **Case III** (page 11-2) pertaining to AutoPilot malfunction.
  - **C-2.** If some other motor function now fails to operate suspect network interference from a faulty AutoPilot network accessory. Replace AutoPilot compass control board and retest.
  - **C-3.** If motor functions properly and it is CoPilot equipped, proceed to **Step 2D**.
- **D.** Disconnect power to motor or stow motor to disable / turn off the system ready LED. Connect the CoPilot network accessory to the network plug from the main control board, if motor is so equipped. Reconnect power or deploy motor to enable / turn on the system ready LED and test motor for proper operation with foot pedal.
  - **D-1.** If motor now fails to respond to foot pedal commands or malfunctions in some other way, the CoPilot receiver board is causing network interference and needs to be replaced.
  - **D-2.** If motor functions properly with foot pedal, but fails to function or respond to the remote transmitter see **Case VI** on page 11-4.

Case IX. Foot pedal doesn't steer motor right/left.

Step 1. Check motor with known good test foot pedal.

A. If test pedal properly steers motor:

A-1. On the customer's pedal: inspect actuators on underside of foot pedal for sand/dirt/grit. See page 11-7 for *Foot Pedal Cleaning Procedure*. Disassemble and remove debris while also inspecting for missing magnets. The Terrova foot pedal needs to be cleaned periodically. Stones, twigs, sand, and other debris can cause pedal buttons to stick and function abnormally. Re-assemble pedal and re-test steering of motor.

A-2. If cleaning the customer's pedal doesn't correct steering, replace foot pedal, if necessary.

B. If test pedal does not properly steer motor, check the drive housing.

B-1. There are 3 different drive housings (12-volt for Terrova 55, 24-volt for Terrova 80, and 36-volt for Terrova 101), but you can test the drive housing by connecting a 12-volt power source directly to drive housing leads. (NOTE: with 12 volts applied, the 24 and 36 volt drive housing steering speed will be noticeable slow.) If drive housing does not steer, open drive housing. Inspect servo motor, drive gears, and bearings for binding/lack of lubrication. Service drive housing to correct malfunction, as needed. If necessary, clean and re-lubricate the gears. If sealed bearings are dry, rough, or binding replace them with p/n 2327308.

Step 2. If above steps test okay, the main control board is faulty and needs to be replaced. See **Case X** below, for information on Control Board Replacement.

Case X. Instructions to replace main control board.

NOTE: Control board should only be removed or replaced if it has been confirmed to be faulty as removal will, in all likelihood, damage the System Ready reed switch.

Step 1. With power to the motor disconnected, remove both Terrova motor sideplates and main control board/speed control cover.

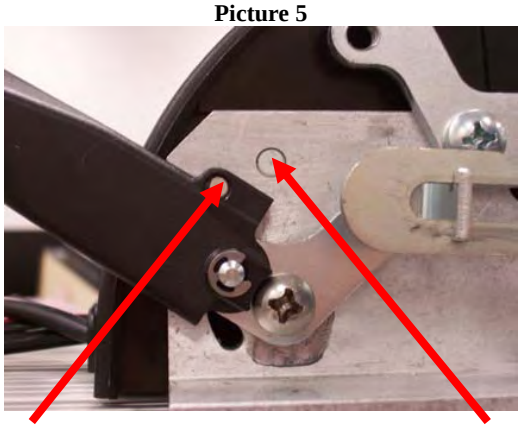
Step 2. Disconnect network plug connections, battery leads, motor leads, system ready and AutoPilot LEDs, and "push-to-test" battery meter leads from the speed control cover.

Step 3. The system ready reed switch is held in the aluminum base extrusion with LocTite® Black Max (an industrial superglue). To remove the reed switch with the least likelihood of damage use a 7/32" punch to drive the reed switch out of the base extrusion. Remove the screws holding the main board, battery leads, and foot pedal plug leads in the reed switch in place. Then lift the control board out of the extrusion.

Step 4. Install new control board in place of the one removed. Reconnect all leads and network plug connections. Install system ready and AutoPilot LEDs in their proper locations in the speed control cover (system ready LED has green and black leads, AutoPilot LED has red and black leads). Consult wiring diagram included with new control board for proper wiring schematic.

Step 5. Install system ready reed switch in base extrusion. Secure in place with a drop or two of commonly available super glue. Note that proper placement of reed switch position calls for the tip of reed switch to be flush with outer surface of base extrusion. **(see Picture 5)**

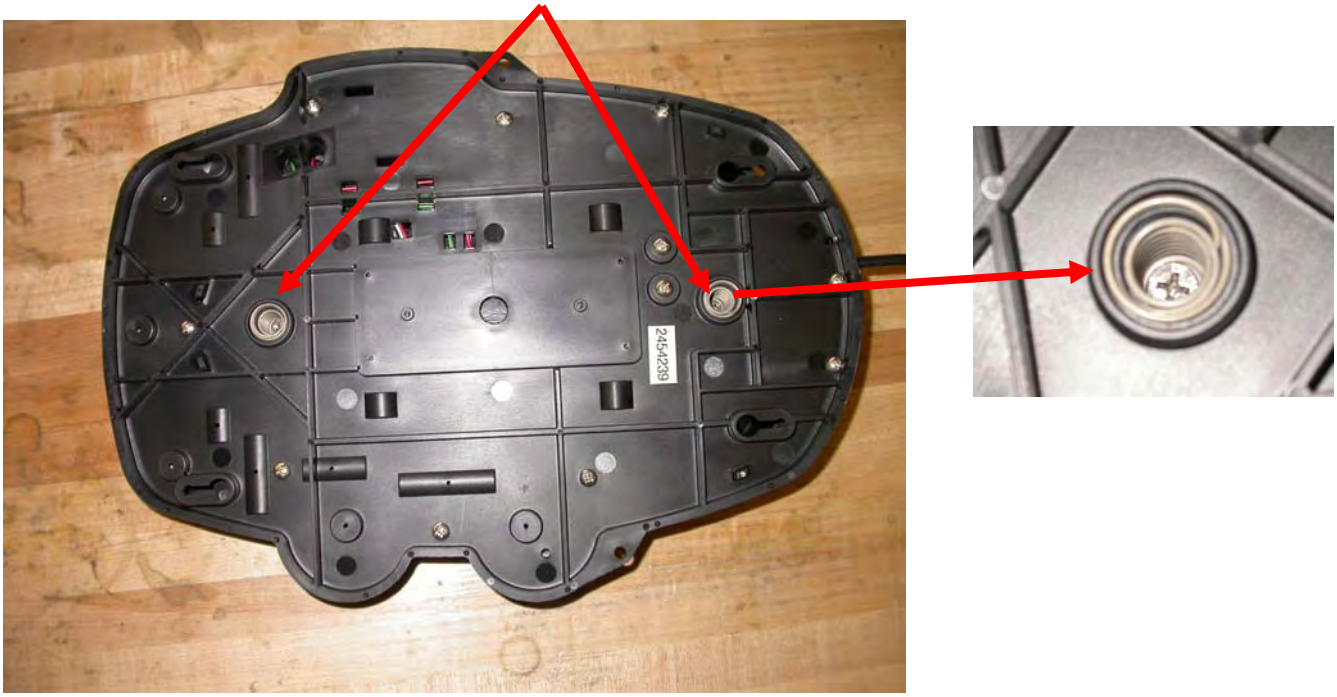
Picture 5



This illustration shows the magnet in the handle cover and the system ready reed switch located in the extrusion.

Foot Pedal Cleaning Procedure

Step 1. Turn the foot pedal upside down and remove the two screws shown with a #2 Phillips screwdriver.



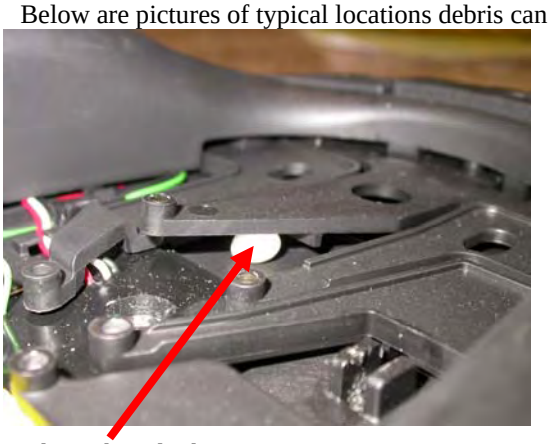
Step 2. Flip foot pedal over and lift heel/toe pedal off

Step 3. Check for rocks, twigs, sand, or other debris that may be lodged under buttons or button arms. The foot pedal is water proof and can be sprayed off or submerged in water to remove any foreign objects such as sand and rocks.

Check for debris stuck between buttons and pedal cover

Check for debris under button arms

Below are pictures of typical locations debris can reside which may cause undesirable foot pedal operation.



Rock stuck under button arm

Rock stuck between button and cover

Step 4. Once the foot pedal is clean the heel/toe pedal can be reinstalled with the original springs and Phillips screws.

Chapter 12.
Foot-Control Cable Steer Models with a Speed Coil

Case I. Motor fails to run

Step 1. Check battery connections, circuit breakers, trolling motor plug (if customer has installed a plug), and any butt splice connections in the battery leadwire.

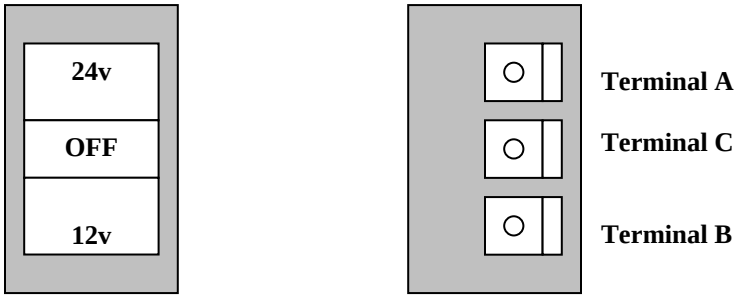
Step 2. Remove the control box cover. Disconnect motor leads and connect 12 volts across red and black motor leads. (This applies to 12 or 24 volt models.)

A. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, bad brush springs, or an open or shorted armature. Repair/replace parts as necessary.

B. If motor does run, check speed selector switch connections and test speed selector switch for continuity across "A" terminal to terminals 1, 2, 3, etc… If switch tests okay, proceed to **Step 3**.

C. Replace speed switch. Test motor for proper operation.

Step 3. If unit being serviced is not a 12/24-volt model, proceed to **Step 4**.
If unit being serviced is a 12/24-volt model, check the 12/24 switch for continuity.



(front side of switch) **(back side of switch)**

A. Turn the 12/24 switch to 12-volt ON position. Check for continuity between the common "**C**" terminal and the "**A**" terminal.

A-1. If no continuity is noted, replace the 12/24 switch. Test motor for proper operation.

A-2. If continuity is observed, proceed to **Step 3B**.

B. Turn the 12/24 switch to 24-volt ON position. Check for continuity between the common "**C**" terminal and the "**B**" terminal.

B-1. If no continuity is noted, replace the 12/24 switch. Test motor for proper operation.

B-2. If continuity is observed, proceed to **Step 4**.

Step 4. If motor being serviced is not working in the CON position, go to **Step 5**.
If motor being serviced is not working in the MOM position, go to **Step 6**.

Step 5. With battery leads connected to power source and MOM/OFF/CON switch in the CON position, connect V.O.M. test leads across terminal block and battery (+) lead. V.O.M. should read battery voltage.

A. If no voltage is noted, remove foot pedal base cover and check connections at MOM/OFF/CON switch.

B. With switch in CON position, check MOM/OFF/CON switch for continuity across center terminal of switch to terminal connected to wire going to terminal block. If there is no continuity, replace MOM/OFF/CON switch. Test motor for proper operation.

Step 6. With the battery leads connected to power source and MOM/OFF/CON switch in the MOM position, connect V.O.M. test leads to terminal block on under side of foot pedal and to battery (+) leadwire or terminal "A" of 5-speed switch.

A. With foot pedal momentary ON/OFF switch depressed, V.O.M. should read battery voltage.

B. If no voltage is present, test foot pedal momentary ON/OFF switch for continuity with ON/OFF switch depressed**.**

B-1. If no continuity is noted, replace foot pedal ON/OFF switch. Test motor for proper operation.
B-2. If continuity is observed, go to **Step 7**.

Step 7. Check for voltage across battery (+) lead and white wire from MOM/OFF/CON switch.
A. If no voltage is noted, remove foot pedal base cover and check connections at MOM/OFF/CON switch.
B. Check MOM/OFF/CON switch for continuity across center terminal to momentary terminal (white wire), with switch in the MOM position.
C. If no continuity, replace MOM/OFF/CON switch. Test motor for proper operation.

Case II. Motor operates on some speeds, not on others.

Step 1. Check to see if all wires are securely attached to the proper switch terminals.

Step 2. Check speed coil functionality.
A. Remove the control box cover. Disconnect wires from the foot pedal from the wires to the lower unit.
B. Connect -12 volts to the black motor/brush lead.
C. Connect +12 volts to each colored speed coil wire coming up from the motor tube. The motor should run (on the separate speed designations) as you make each connection.
D. If the motor fails to run as you touch any of the colored speed coil wires, the problem is either: (1) the speed coil is faulty and needs to be replaced; or (2) the speed coil jumper wire is not connected to the back of the brush plate (in the lower unit).
E. If the motor runs as you touch the +12 volt lead to some of the colored speed coil wires, but not all the speed coil wires, the speed coil is faulty and needs to be replaced.
F. If the motor runs as you touch the +12 volt lead to each speed coil wire, proceed to **Step 3**.

Step 3. Speed switch is defective. Replace speed switch. Test motor for proper operation.

Case III. Motor works at all speed settings, but the customer is complaining that there is no variation between speeds.

Step 1. Perform an amp draw check while the motor is running in a water test tank.
A. If the amps step up as the speed setting increases, the motor is performing as designed.
B. If the amp draw does not increase along with the speed settings check the amp draw of each speed directly through the speed coil:
B-1. Remove the control box cover. Disconnect wires from the foot pedal from the wires to the lower unit.
B-2. With the lower unit still in a water test tank, connect -12 volts to the black motor/brush lead.
B-3. Connect +12 volts to each colored speed coil wire coming up through the motor tube from the lower unit. The motor will run (on the separate speed designations) as you make each connection. Note the amp draw as you test the different colored wires.
a. If the amp draw does not vary as you make the different connections (with the lower unit still in a water test tank) replace the front end bell/potted speed coil assembly.
b. If the amp draw does vary as you make the different connections, replace the 5-speed switch.

Case IV. Motor runs fine, but steering is loose/soft or does not function.

Step 1. Remove control box cover and inspect cable conduit bracket where it attaches to the control box.
A. If conduit bracket is loose or control box attach point is broken, repair/replace parts as needed.
B. If conduit bracket and control box check out fine, inspect steering cables.
B-1 Tighten steering cables by turning adjusting screw at foot pedal clockwise. Turn counter-clockwise to loosen steering cables.
B-2 If steering cable core(s) are broken, replace steering cable assembly per ***Diagram 1*** (page 12-4).
C. Inspect screws at upper bearing race /pinion gear assembly. Screws may have backed out or sheared off. Replace parts, as needed. LocTite screws in place. (Later versions utilize an upper bearing race assembly with 4 screws, while earlier version just used 2 screws.)

Case V. Rope eyelet is worn and quickly wears through pull ropes

If motor being serviced is a Maxxum motor or a RipTide motor with a bowguard 360 assembly that splits horizontally (upper and lower halves):

Step 1. Remove existing, defective eyelet from bowmount bracket assembly.

Step 2. Drill out the eyelet hole in the bowguard bracket with a 27/64" drill bit.

Step 3. Thread the hole with a ½" x 13 tap.

Step 4. Screw new eyelet (p/n 2772352) in place and secure it with a drop of red LocTite™ on the threads.

If motor being serviced is an All Terrain motor with a Hinge Door bracket or a RipTide motor with a bowguard 360 assembly that splits vertically (left and right halves):

Step 1. Remove existing, defective eyelet from bowmount bracket assembly.

Step 2. Drill out the eyelet hole to a 1/2" diameter.

Step 3. Slip the new eyelet (p/n 2772352) into the ½" eyelet opening and secure it with the ½" jam nut provided in the eyelet kit. Use a drop of red LocTite™ on the eyelet threads prior to installing the jam nut.

Case VI. Customer complaint that the motor slides down in the bracket (doesn't maintain consistent depth setting). (Motors prior to 2004 were subject to this issue.)

Step 1. Install Depth Collar Parts Kit, p/n 2771550, using Installation Kit, p/n 2888620. Instructions are included with Kit. The Depth Collar Kit includes an additional depth collar and a new bearing race assembly that utilizes a split collar with 4 screws. The Installation Kit includes a jig and a drill bit so you can properly align the screw holes.

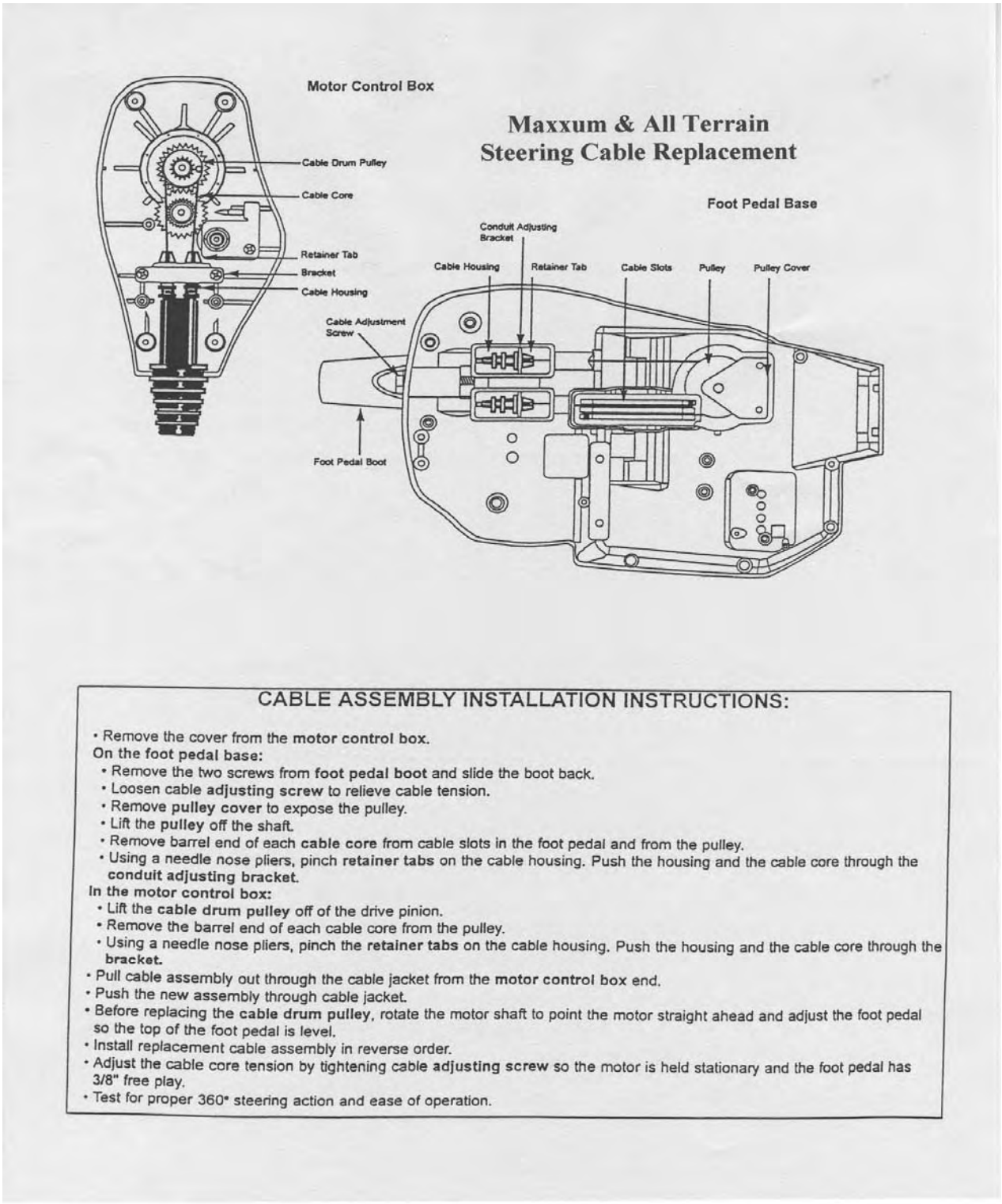

Motor Control Box
Maxxum & All Terrain
Steering Cable Replacement
Cable Drum Pulley
Cable Core
Retainer Tab
Bracket
Cable Housing
Foot Pedal Base
Conduit Adjusting Bracket
Cable Housing
Retainer Tab
Cable Slots
Pulley
Pulley Cover
Cable Adjustment Screw
Foot Pedal Boot
CABLE ASSEMBLY INSTALLATION INSTRUCTIONS:
• Remove the cover from the motor control box.
On the foot pedal base:
• Remove the two screws from foot pedal boot and slide the boot back.
• Loosen cable adjusting screw to relieve cable tension.
• Remove pulley cover to expose the pulley.
• Lift the pulley off the shaft.
• Remove barrel end of each cable core from cable slots in the foot pedal and from the pulley.
• Using a needle nose pliers, pinch retainer tabs on the cable housing. Push the housing and the cable core through the conduit adjusting bracket.
In the motor control box:
• Lift the cable drum pulley off of the drive pinion.
• Remove the barrel end of each cable core from the pulley.
• Using a needle nose pliers, pinch the retainer tabs on the cable housing. Push the housing and the cable core through the bracket.
• Pull cable assembly out through the cable jacket from the motor control box end.
• Push the new assembly through cable jacket.
• Before replacing the cable drum pulley, rotate the motor shaft to point the motor straight ahead and adjust the foot pedal so the top of the foot pedal is level.
• Install replacement cable assembly in reverse order.
• Adjust the cable core tension by tightening cable adjusting screw so the motor is held stationary and the foot pedal has 3/8" free play.
• Test for proper 360° steering action and ease of operation.

Diagram 1

The left cable (when viewed from above the control box) is a few inches longer because it needs to wrap around the pulley in the foot pedal. (right side when viewed from underside of pedal)

Chapter 13.
Foot-Control, Cable Steer Models with a Control Board

This Case applies to motors with the older-style, mechanical on/off (momentary) switch in the foot pedal.

Case I. Motor fails to run

Step 1. Check to make sure that the MOM/OFF/CON switch is not in the OFF position. Check to ensure proper voltage and check polarity at battery (red +, black -). Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery lead wire.

Step 2. Check to insure that all wires are securely attached to the proper control board terminals. (Consult appropriate wiring diagram for the model being diagnosed.) Check for any corroded connections.

Step 3. Remove the control box cover. Disconnect motor leads and connect 12 volts across red and black motor leads. (This applies to 12, 24, or 36 volt models.)

A. If motor runs, reconnect motor leads and proceed to **Step 4**.

B. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, faulty brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.

Step 4. If motor being serviced is not working in the CON position, go to **Step 5**.
If motor being serviced is not working in the MOM position, go to **Step 6**.

Step 5. With battery leads connected to power source and MOM/OFF/CON switch in the CON position, connect V.O.M. leads to battery (-) leadwire and the battery (+) lead/terminal at main control board. (Consult appropriate wiring diagram for motor being diagnosed.)

A. If voltage is present, replace main control board.

B. If no voltage is noted, check MOM/OFF/CON switch for continuity across center terminal to continuous terminal (wire going directly to main control board).

C. If no continuity, replace MOM/OFF/CON switch. Test motor for proper operation.

Step 6. With battery leads connected to power source and MOM/OFF/CON switch in the MOM position, connect V.O.M. test leads to the battery (-) leadwire and the battery (+) lead/terminals at the main control board with ON/OFF switch depressed. (Consult appropriate wiring diagram for the model being diagnosed.)

A. If voltage is present, replace main control board.

B. If no voltage is present, test foot pedal ON/OFF switch for continuity with momentary ON/OFF switch depressed.

B-1. If no continuity is noted, replace foot pedal ON/OFF switch. Test for proper operation.

This Case applies to motors with the magnetic on/off reed switch system.

Case II. Motor fails to run in either the continuous (CON) or the momentary (MOM) mode.

Step 1. Check to ensure proper voltage and check polarity at battery (red +, black -). Inspect all battery connections, trolling motor plug (if installed), and any butt splice connections in battery lead wire. Double check position of the MOM/OFF/CON switch (NOTE: In the CON position the speed selector must be in the 10-100% setting for the motor to run. In the MOM mode the speed selector must be in the 10-100% setting, and the momentary ON/OFF switch on the foot pedal must be depressed for the motor to run.)

Step 2. Remove the control box cover. Disconnect the red and black motor leads and connect 12 volts to these leads. (This applies to 12, 24, or 36 volt models.)

A. If motor runs, reconnect motor leads and proceed to **Step 3**.

B. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, faulty brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.

Step 3. If motor ran when the control board was bypassed, remove the aluminum foot pedal base plate (held in place with screws) to expose the main control board. Check to ensure that all wires are securely attached to the proper main control board terminals. (Consult appropriate wiring diagram for the motor being serviced.) Check for corroded connections.

A. With power applied to the battery leads, using a V.O.M. verify appropriate voltage and proper polarity are present at the battery B+ and B- terminals on the main control board. Make corrections, as needed.

B. If proper voltage and polarity are found at **Step 2A**, remove aluminum cover plate covering the MOM/OFF/CON switch wire connections. Disconnect wire leads to switch and test switch for continuity.

B-1. If no continuity is found, the switch is faulty and needs to be replaced.

B-2. If continuity is found across the switch, reconnect the wires in their proper locations and proceed to **Step 3C**.

C. With power applied to the battery leads, using a V.O.M. test output across main control board motor + and motor – (M+ and M-) terminals. (NOTE: Place MOM/OFF/CON switch in the CON mode and the speed selector in the 10-100% range for this test.)

C-1. If no output is noted across the M+ and M- terminals, the control board is faulty and needs to be replaced.

C-2. If output is found across the M+ and M- terminals, test for output at the red and black motor leads in the control box. If no output is noted at the red and black leads, the problem is in the wiring harness from the foot pedal to the control box. Repair/replace as needed, and test motor for proper operation.

This Case applies to motors with the magnetic on/off reed switch system.

Case III. With speed selector in the 10-100% setting, motor runs in CON (continuous) mode, but not in MOM (momentary) mode when the push button is depressed.

Step 1. Check to ensure the reed switch is properly positioned in the reed switch clip. (Remove the push button/magnet assembly, P/N 2993702, to visually check this.) The tip of the reed switch, (reed switch is a small plastic cylinder with two wires attached), should be flush with the recessed area of the reed switch clip. Re-position reed switch if required. (See installation instructions that come with P/N 2884052 control board kit for clarification and reference.)

Step 2. Check push button/magnet assembly to ensure the small magnet rod on the underside of the push button is in place. (On motors with the new ON/OFF magnetic reed switch, a small rod magnet is used to activate the reed switch.

A. If the magnet is missing from the push button assembly, replace P/N 2993702, and test motor for proper operation.

B. If reed switch and magnet are in place, and the magnet is in close proximity to the reed switch when the push button is depressed, but the motor still does not run then the reed switch is faulty and the main control board needs to be replaced. (The reed switch is not available as a replacement part.)

Case IV. Motor stops running while in use. Motor starts running again after it is pulled up out of the water and is placed back in the water, after the control box is struck, or after the prop is turned slightly.

Step 1. The malfunction listed above is most likely due to an intermittent or marginal electrical connection at the armature windings and commutator.

A. Dis-assemble the motor lower unit. Inspect for water damage. If water is present, repair and replace parts, as necessary.

B. Inspect the armature. Examine the commutator sections for discoloration and arcing caused by the brushes as they make contact with “good/live” commutator sections and “bad/dead” sections. Test armature commutator sections for continuity from one section to the next going around the circumference of the commutator.

B-1. Replace armature if arcing is noted or if no continuity is found when testing commutator sections.

C. Examine commutator section "tangs" that connect armature windings to each commutator section. Each "tang" should be pressed down flush to the brush surface of the commutator section. If any space is noted between the "tang" and the commutator "face" the potential for an intermittent electrical connection exists and the armature needs to be replaced.

Case VI. If motor runs in MOM and CON modes but customer states that the motor starts, stops, or changes speed as the foot pedal is rocked forward and backward (to steer) the potentiometer leads may be at fault.

Step 1. Remove the control board and potentiometer from foot pedal base.

Step 2. Connect power leads directly to control board (consult appropriate wiring diagram for correct voltage, polarity, and terminal locations). You should hear the relay on the control board click when the power leads are connected to the board.

A. Connect a test light (or a known good motor) to the control board motor output terminals. With potentiometer shaft turned clockwise to its stop, the test light (or motor) should be off.

B. As the potentiometer shaft is rotated clockwise, the test light (or motor) should start to light (or run) and increase in brightness (or speed) as you continue to turn the potentiometer shaft clockwise to the switch stop.

C. If the test light (or motor) is intermittent as the potentiometer shaft is turned clockwise OR as the 3-conductor lead connected to the potentiometer is flexed near the potentiometer end, the potentiometer leads are broken, and the control board needs to be replaced.

Case VII. Motor runs fine, but steering is loose/soft or does not function.

Step 1. Remove control box cover and inspect cable conduit bracket where it attaches to the control box.

A. If conduit bracket is loose or control box attach point is broken, repair/replace parts as needed.

B. If conduit bracket and control box check out fine, inspect steering cables.

B-1 Tighten steering cables by turning adjusting screw at foot pedal clockwise. Turn counter-clockwise to loosen steering cables.

B-2 If steering cable core(s) are broken, replace steering cable assembly per ***Diagram 2*** (page 13-6).

C. Inspect screws at upper bearing race /pinion gear assembly. Screws may have backed out or sheared off. Replace parts, as needed. LocTite screws in place. (Later versions utilize an upper bearing race assembly with 4 screws, while earlier version just used 2 screws.)

Case VIII. Rope eyelet is worn and quickly wears through pull ropes

If motor being serviced is a Maxxum motor or a RipTide motor with a bowguard 360 assembly that splits horizontally (upper and lower casting halves):

Step 1. Remove existing, defective eyelet from bowmount bracket assembly.

Step 2. Drill out the eyelet hole in the bowguard bracket with a 27/64" drill bit.

Step 3. Thread the hole with a ½" x 13 tap.

Step 4. Screw new eyelet (P/N 2772352) in place and secure it with a drop of red LocTite™ on the threads.

If motor being serviced is an All Terrain motor with a Hinge Door bracket or a RipTide motor with a bowguard 360 assembly that splits vertically (left and right casting halves):

Step 1. Remove existing, defective eyelet from bowmount bracket assembly.

Step 2. Drill out the eyelet hole to a 1/2" diameter.

Step 3. Slip the new eyelet (P/N 2772352) into the ½" eyelet opening and secure it with the ½" jam nut provided in the eyelet kit. Use a drop of red LocTite™ on the eyelet threads prior to installing the jam nut.

Case IX. Customer complaint that the motor slides down in the bracket (doesn't maintain consistent depth setting). (Motors prior to 2004 were subject to this issue.)

Step 1. Install Depth Collar Parts Kit, P/N 2771550, using Installation Kit, P/N 2888620. Instructions are included with Kit. The Depth Collar Kit includes an additional depth collar and a new bearing race assembly that utilizes a split collar with 4 screws. The Installation Kit includes a jig and a drill bit so you can properly align the screw holes.

Case X. LIFT-ASSIST WARNING

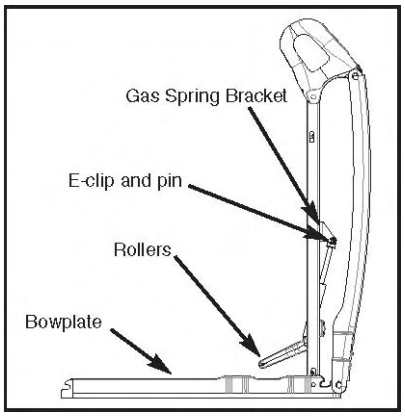
Maxxum Pro:

WARNING: The gas assist lift mechanism in these models are under HIGH SPRING PRESSURE when the motor is in the deployed position. DO NOT remove the BowGuard 360™ assembly from the mount without disconnecting one end of the gas spring. Failure to do this can create a condition where accidental pulling of the rope may cause the mount to spring open rapidly, striking anyone or anything in the direct path!

Maxxum Pro:

To disconnect one end of the gas spring, follow the instructions below:

1. Open mount to approximate position as shown and hold there. Make sure the yoke assembly roller end does not contact bowplate.
2. Remove the e-clip and pin attaching the gas spring to the bracket shown.
3. Lower the mount back to the deployed position.
4. Now it is safe to remove the pins attaching the BowGuard assembly.
5. To re-assemble, attach the BowGuard while mount is in the deployed position. Open mount as shown and reattach gas spring to bracket.



Maxxum Pro Diagram

Fortrex:

To disconnect one end of the gas spring, follow the instructions below:

1. With the mount in the stowed position, locate the upper cylinder pin.
2. Using two Philips screwdrivers, remove 1 of the Phillips flat head screws.
3. Remove pin from outer arm by sliding thru the arm.
4. Now it is safe to deploy the motor and remove the motor assembly.

Fortrex Diagram

philips screw

Maxxum Pro:

REMOVAL OF THE BOWGUARD:

WARNING: The gas assist lift mechanism in this unit is under HIGH SPRING PRESSURE when the motor is in the deployed position. DO NOT remove the BowGuard assembly from the mount without disconnecting one end of the gas spring.

1. Place the motor in the deployed position.
2. Remove the top pin followed by the bottom pin.
   NOTE: When the bottom pin is removed, the stop lever rotates to prevent the latch pin assembly from traveling.

Rope and latch pin assembly should NEVER be pulled as the assembly is under HIGH SPRING PRESSURE.

3. To reassemble:
   - Align the mounting holes for the lower pin.
   - Install lower pin, making sure it passes through the stop lever.
   - Align and install upper pin.

WARNING

MOVING PARTS CAN CRUSH OR CUT

•GAS ASSIST LIFT MECHANISM IS UNDER PRESSURE

•DISCONNECT GAS SPRING BEFORE REMOVING MOTOR FROM MOUNT

•DO NOT PULL ROPE UNTIL GAS SPRING IS DISCONNECTED

NOTE NEVER INSTALL UPPER OR LOWER PINS WITHOUT BOWGUARD / MOTOR ASSEMBLY

Fortrex:

REMOVAL OF THE BOWGUARD:

WARNING: The gas assist lift mechanism in this unit is under HIGH SPRING PRESSURE when the motor is in the deployed position. DO NOT remove the BowGuard assembly from the mount without disconnecting one end of the gas spring.

1. Disconnect one end of the gas spring. see page 6 for instructions.
2. Place the motor in the deployed position.
3. Remove the 5/16" cap screw and lock washer located on the top of the bowguard, in front of the pull rope.
4. Lift motor/Bowguard assembly straight up until bowguard is free from mount.

NOTE: Rope and latch bar should never be pulled with the motor removed as the assembly is under HIGH PRESSURE.

5. **To re-assemble:** Align the key ways on the inside of the bowguard with the ends links on the mount. Lower the assembly straight down until seated Re-install the 5/16" cap screw and washer and tighten.

WARNING

MOVING PARTS CAN CRUSH OR CUT

•GAS ASSIST LIFT MECHANISM IS UNDER PRESSURE

•DISCONNECT GAS SPRING BEFORE REMOVING MOTOR FROM MOUNT

•DO NOT PULL ROPE UNTIL GAS SPRING IS DISCONNECTED

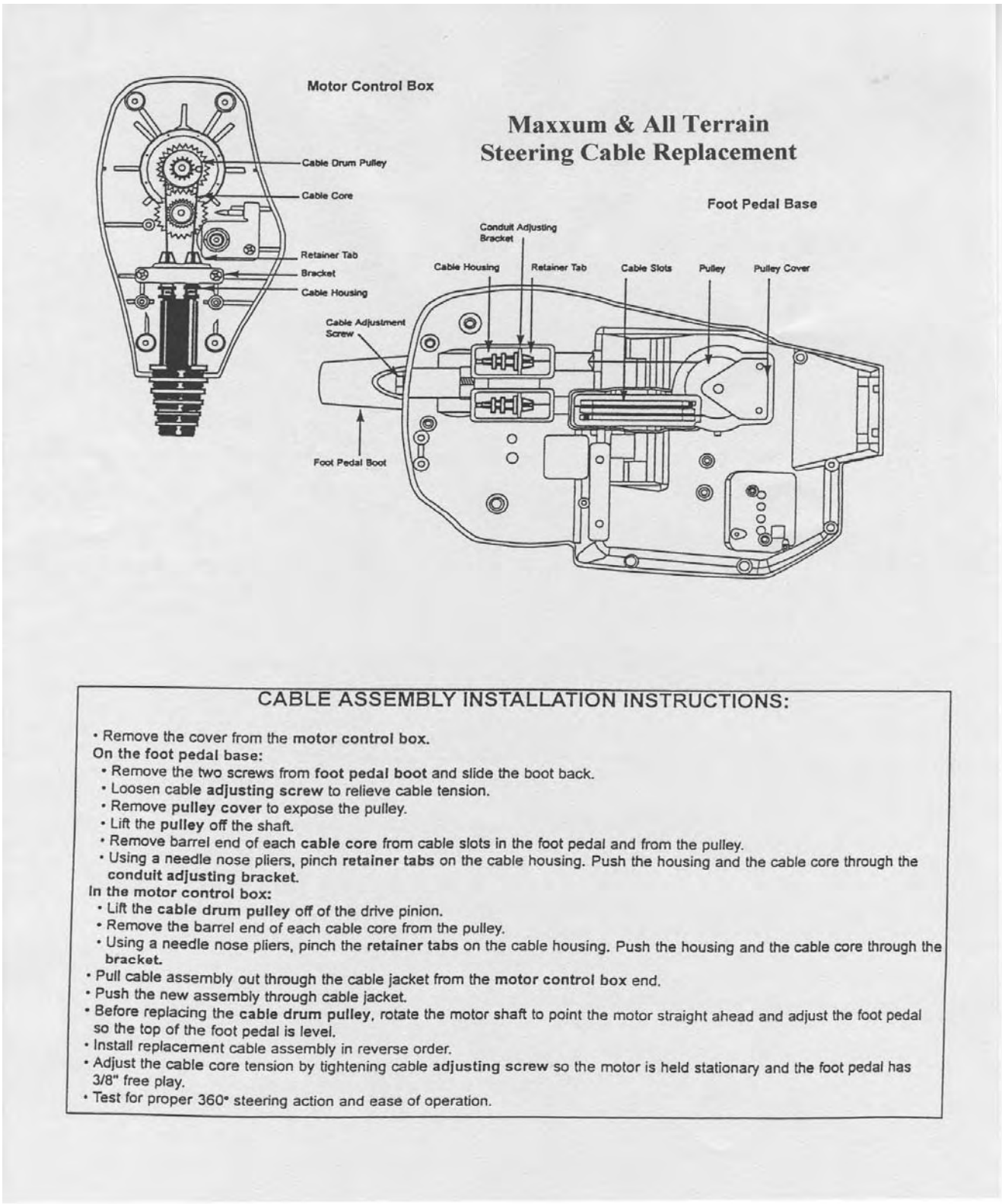

Motor Control Box
Maxxum & All Terrain
Steering Cable Replacement
Cable Drum Pulley
Cable Core
Retainer Tab
Bracket
Cable Housing
Foot Pedal Base
Conduit Adjusting Bracket
Cable Housing
Retainer Tab
Cable Slots
Pulley
Pulley Cover
Cable Adjustment Screw
Foot Pedal Boot
CABLE ASSEMBLY INSTALLATION INSTRUCTIONS:
• Remove the cover from the motor control box.
On the foot pedal base:
• Remove the two screws from foot pedal boot and slide the boot back.
• Loosen cable adjusting screw to relieve cable tension.
• Remove pulley cover to expose the pulley.
• Lift the pulley off the shaft.
• Remove barrel end of each cable core from cable slots in the foot pedal and from the pulley.
• Using a needle nose pliers, pinch retainer tabs on the cable housing. Push the housing and the cable core through the conduit adjusting bracket.
In the motor control box:
• Lift the cable drum pulley off of the drive pinion.
• Remove the barrel end of each cable core from the pulley.
• Using a needle nose pliers, pinch the retainer tabs on the cable housing. Push the housing and the cable core through the bracket.
• Pull cable assembly out through the cable jacket from the motor control box end.
• Push the new assembly through cable jacket.
• Before replacing the cable drum pulley, rotate the motor shaft to point the motor straight ahead and adjust the foot pedal so the top of the foot pedal is level.
• Install replacement cable assembly in reverse order.
• Adjust the cable core tension by tightening cable adjusting screw so the motor is held stationary and the foot pedal has 3/8" free play.
• Test for proper 360° steering action and ease of operation.

Diagram 2

The left cable (when viewed from above the control box) is a few inches longer because it needs to wrap around the pulley in the foot pedal. (right side when viewed from underside of pedal)

Chapter 14.

Genesis

Tools *Required* for Servicing Genesis motors:

- **Test Foot Pedal** – Minn Kota p/n 2772040T (has trim actuator removed for programming purposes)
- **Mini Butane Torch Kit** - can be purchased over the Internet from MicroFlame (www.microflame.com) or equivalent.
- **360º Rotatable Repair Stand** - non-ferrous material for AutoPilot calibration
- **Quick-Release Mount** – Minn Kota p/n 2771895 to mount to your rotatable stand
- **Loctite™ #603**
- **V.O.M.** – multi-meter
- **Allen Wrench** - .050"

Error Codes & Probable Causes …… page 14-2

Steering System Module …… page 14-3

Lift System / Trim System Module …… page 14-7

AP/PD Housing Module …… page 14-16

Foot Pedal Module …… page 14-17

To Re-Orient Steering Potentiometer to Motor Position …… page 14-19

Lower Shaft Collar Replacement …… page 14-20

Master Reset / Emergency Override …… page 14-21

Identifying Software Version Code …… page 14-22

Steering Potentiometer Testing & Replacement …… page 14-23

Control Board Replacement & Programming

When replacing the control board you will need to do the Initial Programming (and if the unit is an AutoPilot, you will also need to do the Calibration Procedure).

A. Control Board Replacement …… page 14-25
B. Initial Programming Procedure …… page 14-27
C. Calibrating AutoPilot Compass …… page 14-29

AutoPilot Steering Malfunction …… page 14-31

GENESIS - Error Codes & Probable Causes

NOTE: Neither the steering motor nor the propeller should operate when the motor is in the stowed position. If so, it is a definite indication that the counter has lost its reference and a Master Reset is required (*see page 14-21*). Also, check to insure proper lift belt tension (*see page 14-7, Case I*).

ER1 Foot pedal is not sending information to motor
- *Inspect pedal wire for damage*
- *Water may be in plug assembly*
- *Test with new foot pedal (Test Pedal p/n 2772040T)*

ER3 Sensor board in control head is sending invalid information
- *Check orange coil cord wire for continuity*
- *If orange wire is okay, the lower unit may have been rotated more than one full turn*
  - *Re-orient steering potentiometer to motor position (see page 14-19)*
- *If motor spins in circles, you may need to re-set park position values (see page 14-6)*

ER4 Sensor board in control head is not sending information
- *Check coil cord brown and yellow wires for continuity*
- *Check to make sure that the steering potentiometer belt is in place and that all wire connections to the steering potentiometer board are tight*
- *Test steering potentiometer and replace, if necessary (see page 14-23)*

ER5 Steering motor has power applied to it, but steering is not functioning
- *Lower unit assembly may be stuck in underwater obstructions*
- *Primary gear drive screws backed out (see page 14-3)*
- *Check coil cord white and blue wires for continuity*
- *Anti-rattle bushing not in proper place (see page 14-3 & 14-5)*
- *If ER5 occurs while motor is stowed it may be due to improper lift belt tension. Adjust lift belt tension (see page 14-7, Case I)*
- *Check to ensure setscrew on the steering potentiometer gear is not stripped (causing gear to spin on steering pot shaft without changing pot values)*
- *Steering motor may be overheated (the steering motor should draw less than two amps while steering in a "no load" or "on-the-bench" situation)*

Check the next 2 circumstances particularly if you can hear the steering motor running in the control box for a few seconds, but the lower unit does not steer (prior to ER5 being displayed):
- *Steering motor output gear broken internally (see page 14-4, Case V)*
- *Set screw mating the worm gear to the steering motor shaft is loose (see page 14-4, Case V)*

ER6 Lift system is not responding
- *Motor is blocked and cannot trim up or down – remove obstructions*
- *Shaft position counter lost reference possibly due to improper lift belt tension. Adjust lift belt tension (see page 14-7, Case I)*
- *Coupler gear broken (see page 14-7, Case III)*

LP Low power - less than 8 volts for 12v units and 16 volts for 24v units (under load)
- *Check power source, all connections, and external plugs for loose or faulty contacts (most LP error codes are traced back to faulty/loose connections at battery or plug)*

CL Propeller is blocked
- *Clear propeller obstructions*

Propeller OFF *MOM/CON switch is in CON (Constant On) position, turn to MOM (momentary) position*

Multiple Error Codes Simultaneously (LCD flickers many codes)
- *Defective foot pedal – replace pedal (see page 14-18, Case VIII)*

GENESIS - Steering System Module

(see also: Foot Pedal Module, page 14-17 and/or AutoPilot Steering Malfunction, page 14-31)

Case I. Steering Motor tries to run (audible ticking sound in control box), but motor does not steer (steering is "jammed").

Step 1. Remove Genesis control box cover and visually inspect the two flathead, countersunk screws that hold the primary gear into the inner shaft tube (items #49 of the Steering Module parts explosion). These two screws must be flush with the aluminum-locking collar on the inner shaft/tube. If they are not flush with the outer surface of the locking collar, the steering system will bind and will not steer. This will also affect the stow/deploy sequence of the Genesis motor, as the unit must be able to steer in order to properly deploy and stow.

A. If screws are loose, remove them one at a time and visually inspect the screw threads and the threads in the primary gear.

A-1. If threads are O.K. in both parts, reassemble with **Loctite #603** & primer on threads of retaining screws and fully tighten to seat screws so they are flush with the outer surface of the aluminum-locking collar.

A-2. If threads in primary gear or on retaining screws are stripped or cross threaded, replace them with new parts. Use **Loctite #603** & primer when reassembling the primary gear, locking collar, and retaining screws. Be sure to fully tighten the retaining screws so that the heads are flush with the surface of the locking collar. (See Genesis Transducer Routing, **Service Bulletin #41400**, Part II & III for proper disassembly).

B. If screws in primary gear are not loose but steering is binding or "jammed", the p/n 2227324 anti-rattle bushing may be out of place. This is especially true if the motor has been disassembled for internal routing of the transducer cable.

B-1. To correct this malfunction, disassemble the Genesis motor as per the Transducer Routing Procedure. (See Parts II - VI of **Service Bulletin #41400** for proper disassembly).

B-2. Replace anti-rattle bushing if detent catch on bushing is damaged/broken.

B-3. Put anti-rattle bushing back in its proper place making sure that the detent catch is secure in the hole provided in the outer shaft lift belt channel. (see below)
(On 45" shaft models, the cam profile will extend over the hole in the tube when motor is fully assembled.)

Case II. Steering motor has overheated and smoked due to "jammed" steering condition, (see Steering System Malfunction Case I). Steering motor will need to be replaced.

Step 1. Correct malfunction that is causing the "jammed" condition as outlined in Case I.

Step 2. Disassemble unit per Parts I, II and III of Transducer Routing Procedure (**Service Bulletin #41400**) stopping at Step 2 of Part III.

- **A.** Remove the four screws holding the steering chassis to the lower control box. (See Genesis Steering Module parts explosion).
  - **A-1.** Lift steering chassis out of the control box and turn it over to access the steering motor retaining screws, p/n 2223427. (See parts explosion).
  - **A-2.** Remove the three screws that hold the steering motor onto the underside of the steering chassis.
- **B.** Replace the steering motor assembly with the appropriate part (p/n 2777805 for 12V model and p/n 2777806 for 24V Genesis).
  - **B-1.** Reassemble using the original bronze helical gear, transmission coupler, and motor gear. (See steering Module parts explosion).

Step 3. Place reassembled steering motor/chassis assembly back into the control box. Reassemble in reverse order of disassembly. Note: be sure to inspect the threads in the primary gear and on the retaining screws. Replace if required. Use **Loctite #603** and primer on retaining screws. Tighten screws to the point that they are flush with the aluminum-locking collar on the inner shaft tube.

Step 4. After reassembling Genesis motor, connect it to the appropriate voltage and test for proper operation.

Case III. Genesis unit deployed, lower unit turned but now will not steer or stow.

Step 1. Steer system is "jammed". (See Genesis Steering System Module, Case I and II to correct cause of malfunction.

Case IV. Genesis unit responds to heel/toe steering pedal inputs but right momentary steer button is intermittent, delayed, or not responding.

Step 1. Replace malfunctioning foot pedal assembly. (p/n 2772040).

Step 2. Connect Genesis motor to the appropriate voltage and test for proper operation.

Case V. Genesis steering motor runs (can be heard running in the control box), but motor lower unit does not turn.

The output gear on the steering motor (item #37 on the Steering Module parts explosion) may be broken or the set screw (item #33), mating the worm gear, (item #32) to the steering motor shaft is loose allowing the worm gear to slip.

Step 1. Remove control box cover and visually inspect all steering clutch gears and output shaft gear.

- **A.** If gears are broken or damaged, replace as required.
  - **A-1.** To replace broken output shaft gear, see Steering System Module Case II, Steps 1 & 2 for steering motor removal and consult your Genesis Steering Module parts explosion for correct steering motor assembly.
  - **A-2**. Replace broken output gear, reassemble and test Genesis motor for proper steering functions.
- **B.** If all gears check okay, the setscrew in the worm gear is loose.
  - **B-1.** Disassemble steering system as per Case II, Step 2 (Steering System Module).

B-2. Remove steering motor from chassis and consult Steering Module parts explosion for location of worm, (item #32) and setscrew (item #33). (The transmission housing needs to be removed from the steering motor.) The setscrew should tighten against the flat side of the shaft. Tighten as required using a .050" allen wrench and Loctite the screw in place. Reassemble and test Genesis motor for proper steering function.

Case VI. If Genesis motor has been disassembled for transducer routing procedure and is now assembled and will not steer.

Step 1. Check to make certain that the anti-rattle bushing is in its proper place. (see below)
(On 45" shaft models, the cam profile will extend over the hole in the tube when motor is fully assembled.)

A. The anti-rattle bushing catch must be in the hole provided in the lift belt channel. If it is pushed out of position during reassembly after transducer routing, the Genesis motor will not steer or will steer with great difficulty.

A-1. Disassemble the motor per the transducer routing procedure to correctly position the anti-rattle bushing back in its proper place.

A-2. Reassemble the Genesis motor and test all functions for proper operation.

Step 2. Visually inspect the primary gear retaining screws for proper installation and tightness (*see Steering System Module Case I, Step 1 on page 14-3*).

Step 3. Correct cause of steering problem, reassemble, and test unit for proper function.

Case VII. Prior to stowing, lower unit doesn't steer perpendicular to the mount so that the lower unit lays flat on the motor rests.

Step 1. Re-orient steering potentiometer to the lower unit motor position (*see page 14-19*). As per this procedure, it may be necessary to reprogram the left and right park position values into the control board (*page 14-27).*

Step 2. Run unit through several stow/deploy cycles to test unit for proper function.

Case VIII. Motor steers in circles when foot pedal is turned ON.

If motor continues to spin in circles until ER5 is displayed, check to ensure the setscrew on the steering potentiometer pulley gear is not stripped (causing pulley to spin without changing pot values).
If motor steers until the steering pot hits the end of the 10-turn pot, (may display ER3) proceed to Step 1.

Step 1. Test the steering potentiometer resistance values (*per Steering Potentiometer Testing and Replacement - Step 3 on page 14-23*).
- **A.** If steering pot tests bad, follow instructions as directed (*page 14-23*).
- **B.** If steering pot tests good, proceed below to **Step 2**.

Step 2. With Master Switch OFF, remove the control box cover.
- **A.** Slip the belt off the primary gear and steering potentiometer gear.
- **B.** Place the motor lower unit in-line with the bowmount / base housing with the prop towards you when looking straight at the LCD. (NOTE: you may need to forcefully turn the motor by hand to place it in this position.)
- **C.** Turn steering potentiometer counter clockwise to its rotational stop.
- **D.** From the rotation stop, turn the potentiometer exactly five complete turns clockwise and slip the belt back onto the steering potentiometer and primary gear without turning the steering potentiometer or lower motor assembly out of position.

Step 3. Reset the Left and Right Park Position values.
IMPORTANT NOTE: The motor may immediately start steering after releasing the buttons described in **Step 3A**. If this happens, disengage the steering **A.S.A. P.** by pressing and releasing a momentary steering button!
- **A.** Using the test foot pedal (p/n 2772040T), press and hold both the TrimUp and TrimDown buttons while turning the Master Switch ON, then release both trim buttons. Disengage steering if motor starts to spin as called out in *above IMPORTANT NOTE*.
- **B.** LCD display on motor should read "LFT".
  - **B-1.** If LCD shows *"SET PROPELLER"* turn pedal OFF and perform Master Reset (as described on page 14-21). Deploy the motor. Then return to **Step 2** above.
  - **B-2.** If LCD shows *"SET STRAIGHT AHEAD"* then both TrimUp and TrimDown buttons were not pushed simultaneously. Turn pedal off and return to **Step 3** above.
- **C.** Use the momentary steering buttons to place the motor lower unit in propeller left park position. (Left park position is motor lower unit at a 90 ^{o} angle to the Genesis base housing with the prop pointing to the left when viewing the LCD.)
- **D.** Press the "Momentary ON" switch located on heel/toe steering pedal once to enter this setting into the main board "memory".
- **E.** LCD on motor should now read "Rt".
- **F.** **NOTE: In this step, the motor lower unit must be rotated counterclockwise (when looking down at the motor lower unit).** Use the Left Momentary Steering Switch to rotate motor lower unit from left park position to right park position. (Right park position is motor lower unit at a 90 ^{o} angle to the Genesis base housing with the prop pointing to right when viewing the LCD.)
- **G.** Press "Momentary ON" switch located on the heel/toe steering pedal once to enter this setting into the main board memory.

Step 4. Set the Shaft Length (after setting the Park Positions, the shaft length setting will display)
- **A.** Use the right momentary steering switch to "toggle" through the shaft lengths until the correct shaft length for the motor is displayed (45, 52, or 60).
- **B.** Press the "Momentary ON" switch located on the heel/toe pedal once to enter this correct setting into the main board memory. (NOTE: if the shaft length is already set correctly, the TrimUp switch may be pressed to skip or "toggle" through this portion of the procedure.)

Step 5. The TrimUp switch may be pressed to toggle through the Lift Motor Condition, and Offset Tables.

Step 6. After toggling through the Offset Table portion, the LCD on the motor will display "---". Turn the Master Switch OFF to "lock" all steps of this procedure in the main board memory and to return motor to normal operating mode.

Step 7. Test motor for proper operation.

GENESIS - Lift System / Trim System Module

Case I. Motor makes loud ratcheting sound when deploying / stowing, ER6 may display.

Step 1. Check lift belt tension for proper adjustment.

- **A.** With the motor in the DEPLOYED position, trim the motor to its highest trim height.
- **B.** Torque the lift belt tensioning screw to 6-7 inch/pounds. (Tensioner screw is located on the underside of the control box.)
- **C.** Perform the Master Reset Procedure to reset shaft position counter (*see page 14-21*).
- **D.** Retest motor for proper deploy/stow sequence. If lift belt is still slipping, tighten lift belt tension screw one full turn and retest. Repeat if necessary until motor stows/deploys properly.

Case II. If Genesis displays "use trim" when in the stowed position, or motor does not stow, deploy, or trim down all of the way (ER6 may also display), the shaft position counter has lost reference and must be reset.

Step 1. Perform Master Reset (*see page 14-21*).

Case III. Genesis motor displays ER6 and/or lift motor can be heard running but motor does not deploy/stow.

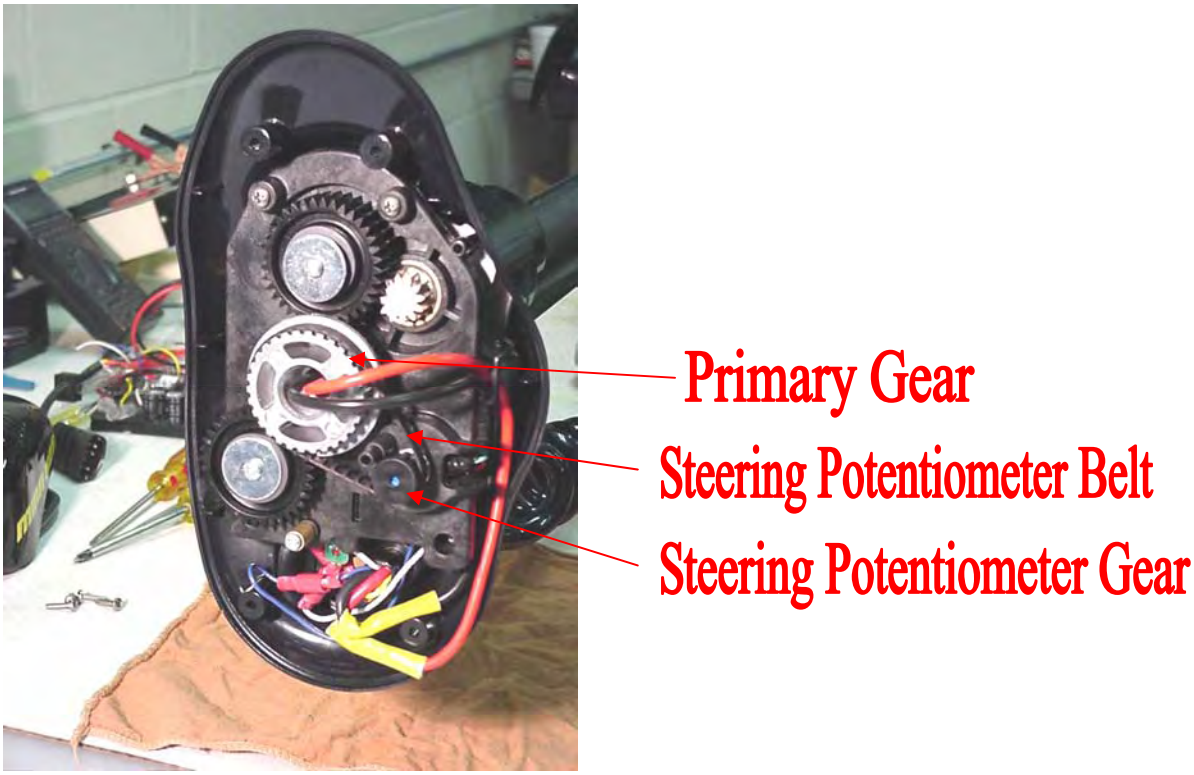
Step 1. Inspect lift belt for cuts, damage and proper tension. If all checks okay, proceed to lift motor removal below. If lift belt is damaged, go to Case IV of this Lift / Trim System.

- **A.** Unscrew sideplate screws (items #37 and #38) to remove the right sideplate. Consult Genesis AP/PD Base/Housing Parts explosion for reference.
- **B.** Remove the three screws, (item #22) that attach the lift motor, (item #20) to the lift motor mount.
- **C.** Locate and examine the lift motor drive gear/coupler, (item #19) for damage.
  - **C-1.** If gear is split or if "blade" across the inside diameter of the gear is broken, replace it with new parts from Minn Kota. <u>This gear has been changed:</u>
    serial numbers beginning with **MKAA** & serial numbers **GNAB0002697 and below** need the *p/n 2222208* gear.
    - S/N between **GNAB0002698 to GNAC1002726** & **all GNRW (Re-worked serial numbers)** need *p/n 2222209* gear.
    - S/N **GNAC1002727 and above**, need *p/n 2222214* coupler gear.
  - **C-2.** The p/n is molded on to the end the end of the coupler. Identify the correct coupler gear needed by checking the broken part.
- **D.** Reassemble motor in reverse order of disassembly and test all functions for proper operation.
  - **D-1.** Perform Master Reset/Emergency Override procedure to reset shaft position counter if motor does not fully stow/deploy after lift gear coupler is replaced.

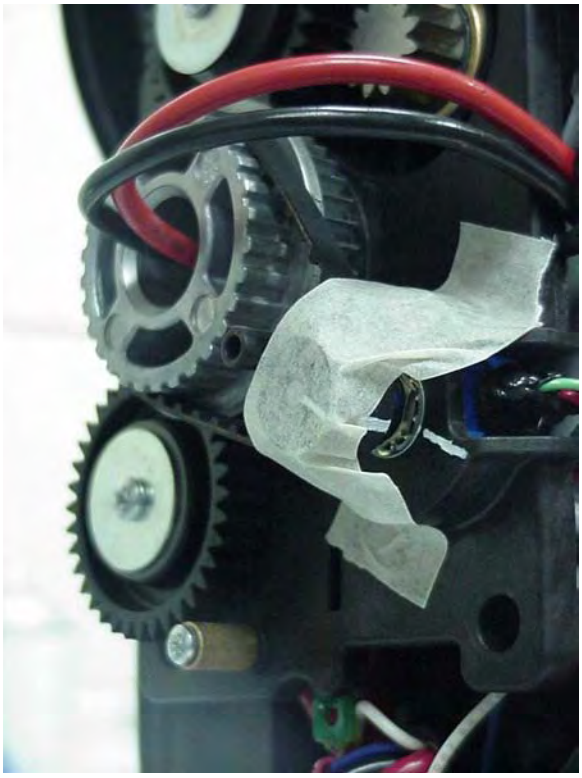
Case IV. If the lift belt has been accidentally cut or damaged but is still routed through the lift housing; it can be replaced without disassembling the lift housing. **(If it is not still routed through the housing, refer to Case V on page 14-13 for instructions on splitting the lift housing.)**

Step 1. With motor in fully stowed position, place "Quick Grip" clamp on lower unit and lift housing. (see figure below)

Step 2. Remove the control box cover screws and cover assembly to expose the Genesis steering system. (see below)

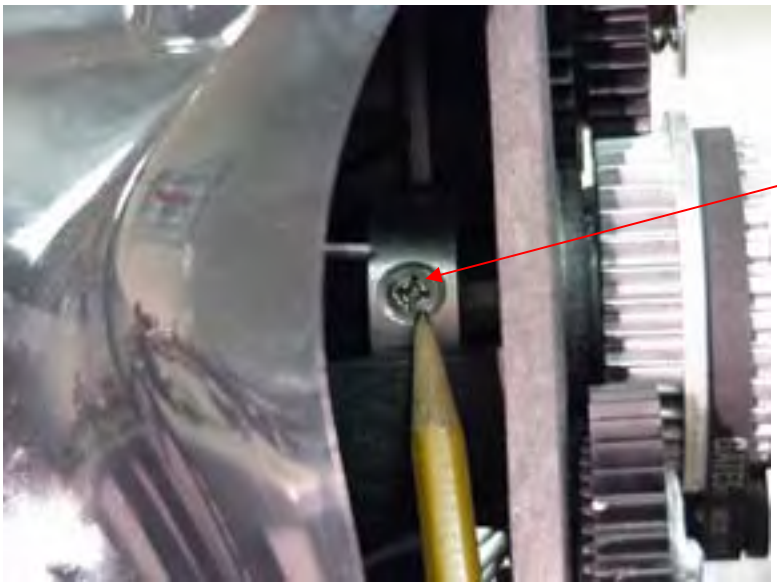


A. Mark and tape the steering potentiometer (as shown below).

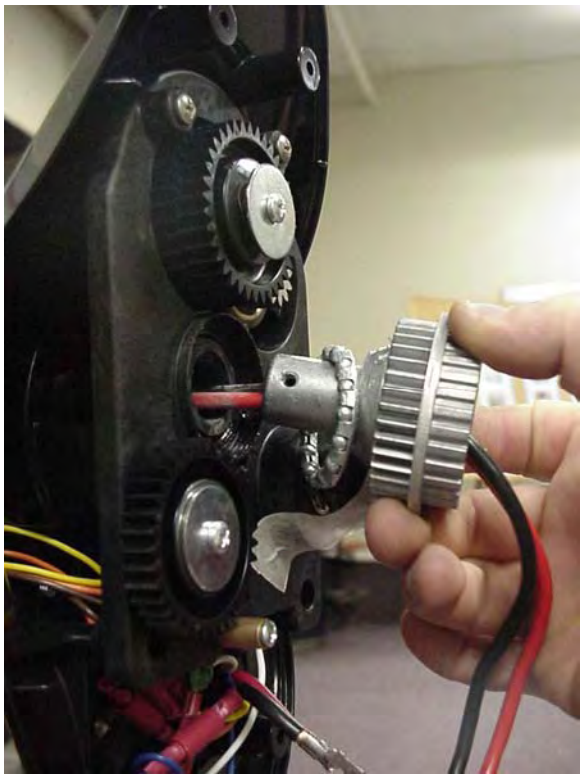


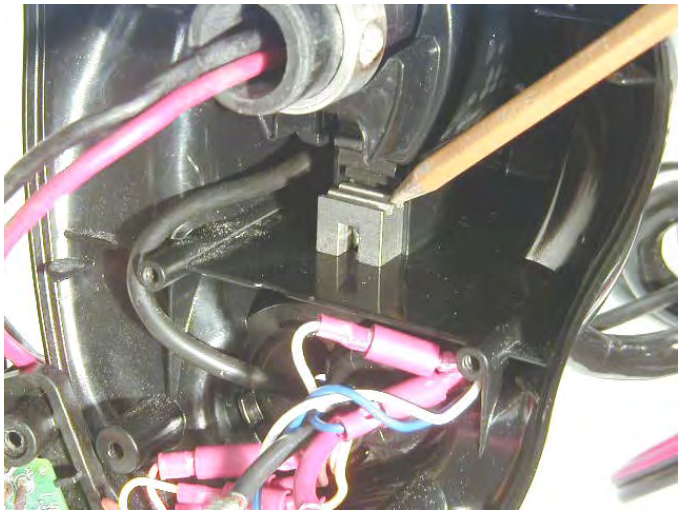
B. Disconnect the red and black motor leads and slip steering potentiometer belt up and off of the primary gear. (Take care not to rotate the steering potentiometer).

C. Remove the two Phillips Flathead countersunk screws that hold the primary gear assembly in the inner shaft. **Note:** Heat will be required to remove these screws, as they are held in place with **LocTite**.

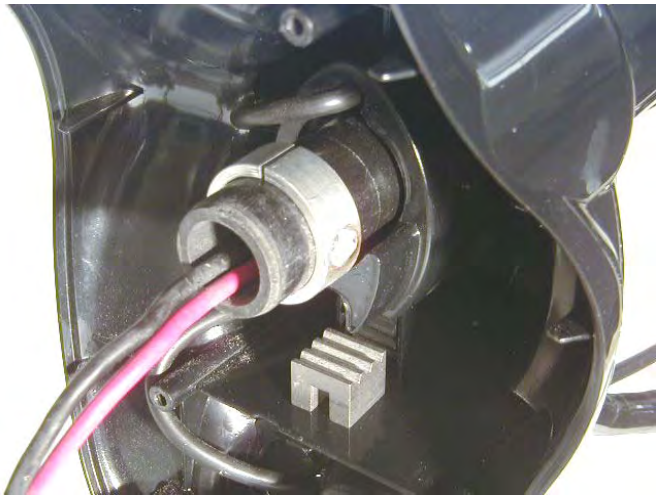


Step 3. Remove the primary gear and top bearing from the steering chassis. Then remove the four screws that attach the steering chassis to the control box. This will enable you to access the lift belt tensioner. (see figures below)

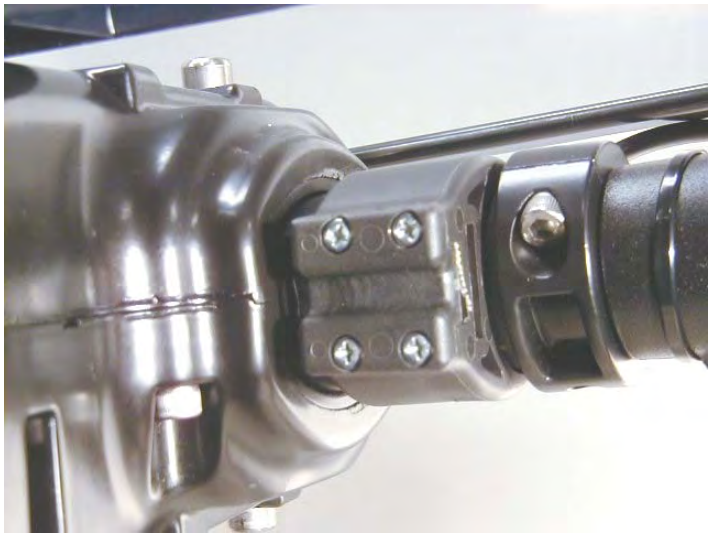




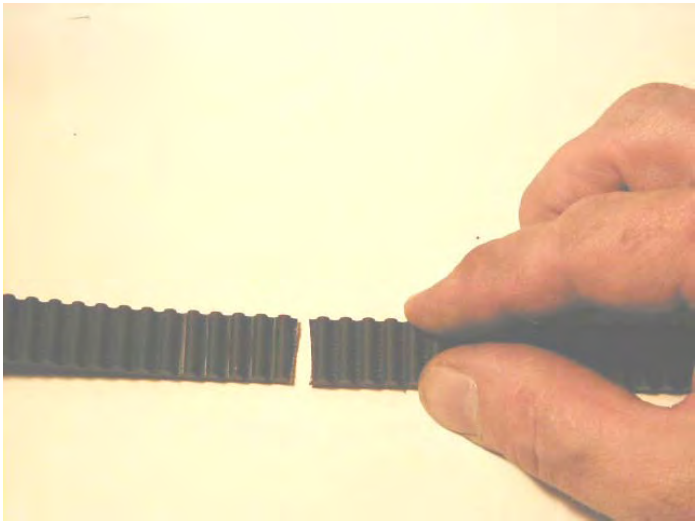
A. Unscrew lift belt tension screw all the way while observing the lift belt tensioner. Note how the tensioner engages the teeth on the upper end of the lift belt. (see below)

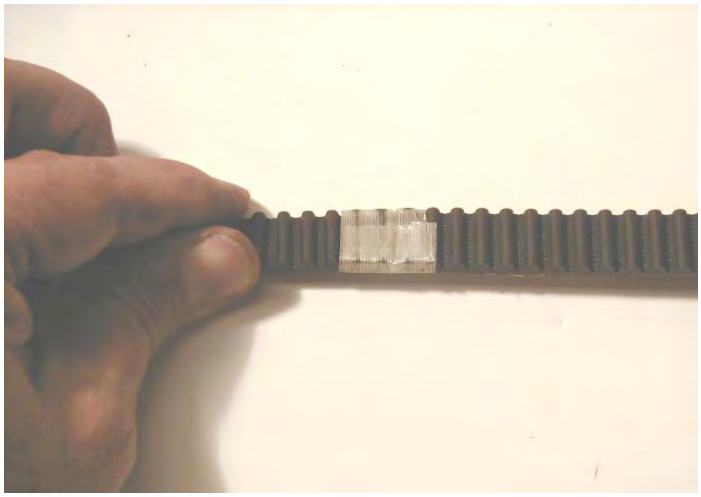


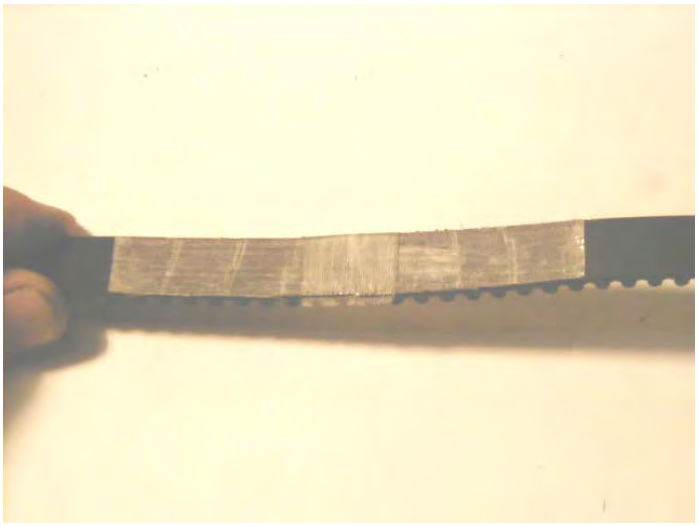
Step 4. Remove the four screws that attach the lower end of the lift belt to the outer shaft lower collar. (see below)



A. Butt the ends of the new and old lift belt together, add a drop of super glue, and securely tape them to each other (as shown in the 3 figures below). Note: Be sure that the length of the new lift belt matches the shaft length of the motor being serviced.







B. With the two belts glued and taped together, push the belt into the bottom of the lift housing while at the same time pulling the lift belt out the opposite side of the lift housing. In this manner you can push/pull the new lift belt into position for reassembly and attachment to the outer shaft collar and lift belt tensioner.

Step 5. With new lift belt attached at top and bottom tighten the lift belt tension screw to the point that a moderate pull on the belt (approx. 10# pull) will deflect the belt ½" to ¾" from the outer tube.

Step 6. Reassemble the steering chassis in the control box and reinstall the primary gear and primary gear retaining screws. Note: Use **Loctite #603** and primer when reassembling). Replace primary gear and screws if threads in primary gear are stripped, cross-threaded, or damaged in any way.

A. Reinstall the steering potentiometer belt, reconnect the red and black motor wires, and reinstall control box cover and directional indicator.

Step 7. Connect Genesis motor to appropriate power source and test for proper deploy/stow as well as all other motor functions. If necessary, perform Master Reset/Emergency Override procedure (*see page 14-21*) to reset the shaft position counter. You may also need to re-orient the steering potentiometer to the lower unit position (*page 14-19*) if the potentiometer was accidentally moved.

Case V. When the MODE switch is pressed to stow the Genesis motor, the motor shaft raises vertically and the motor lower unit contacts the underside of the bowmount. (Motor does not rotate into the horizontal position for proper stowing.)

NOTE: Ensure the lift cam is in its proper place in the channel of the outer tube. The catch on the end of the lift cam needs to prevent the lift cam from sliding in the channel. If this is okay, a faulty gear/shaft or broken chain in the lift housing assembly causes this malfunction. To determine which part is at fault, the lift housing must be removed from the base/housing assembly and disassembled for internal inspection.

Step 1. Consult the step-by-step disassembly procedures outlined in the Genesis Transducer Cable Routing, (**Service Bulletin #41400**) Part II, III, and IV-Steps 1 and 2. Disassemble the Genesis motor by following the steps as indicated.

Step 2. Remove the four screws holding the steering chassis assembly (item #19 of the Steering Module parts explosion) into the lower control box (item #13 of the Steering Module parts explosion). Disconnect the steering chassis wires as needed.

A. Unscrew the lift belt tension screw (item #17 of the Steering Module parts explosion) while observing the lift belt tensioner. (see figure below) Note how the lift belt is routed and attached to the tensioner for later reassembly.

B. Remove the belt tensioner and control box from the outer tube (item #8 of the Steering Module parts explosion).

C. With the lift belt loose from the top and bottom of the outer tube, pull the outer shaft out of the lift housing (leaving the lift belt in place through the lift housing assembly).
ATTENTION: For proper reassembly you must note the position of the lift housing in the aluminum base assembly (i.e. stowed or deployed position) and the position of the outer tube in the lift housing (you may want to mark the parts accordingly). Also note the top/bottom of the outer tube (the lift cam in the belt channel of the tube is towards the bottom). The lift housing and outer tube should be reassembled so as to place them in the same positions they were in prior to disassembly. Failure to do so may disrupt the "timing" of the lift housing rotation and cause internal gear damage.

Step 3. Remove the right and left Genesis sideplates from the base/housing assembly (item #35 and #36 on the Base/Housing parts explosion).

A. If the motor being serviced has a dampener arm (shock absorber), detach the end of the dampener from the lift housing.

B. Remove the three screws (item #22 of the Base/Housing parts explosion) that hold the lift motor in place (item #20 of the Base/Housing parts explosion).

C. Remove the lift motor and lift motor drive gear (item #19 on the Base/Housing parts explosion).

D. Remove the three screws (item #17 of the Base/Housing parts explosion) that attach the motor mount spacer (item #16 of the Base/Housing parts explosion) to the base extrusion.

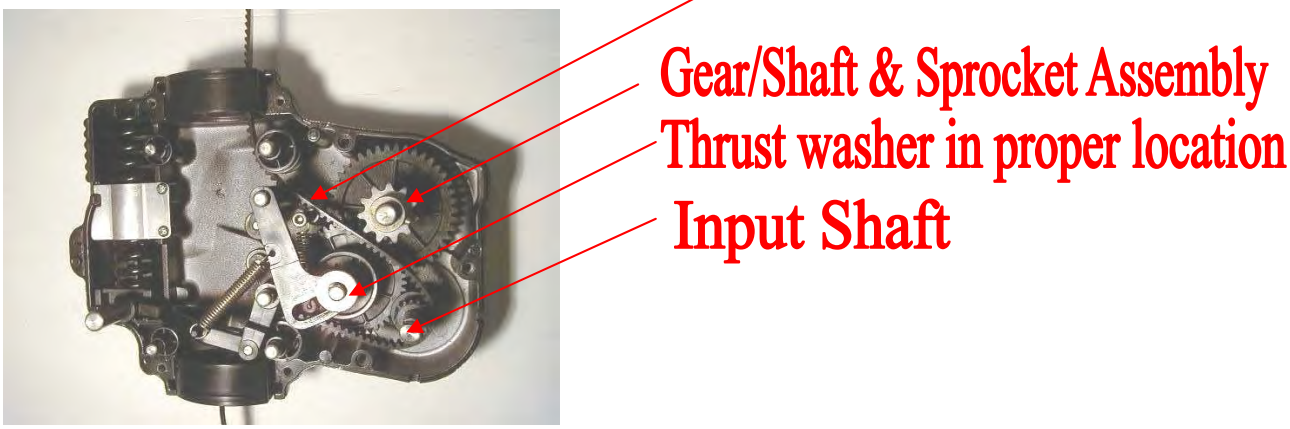
E. On the side opposite the lift motor, remove the screw, encoder bracket, and encoder wheel (items #26, #25, and #24 of the Base/Housing parts explosion).

F. Remove the three button head cap screws (item #23 on the Base/Housing parts explosion) that attach the lift housing to the base extrusion. NOTE: These three screws are secured with Loctite™. Apply heat as needed to remove them.

Step 4. Remove the lift housing from the base extrusion and place on workbench with left side/socket head capscrews up.

A. Remove the eight ¼ x 20 socket head capscrews (item #50 of the Lift Housing parts explosion) that hold the left and right halves of the lift housing together.

B. With the eight screws removed, use a blade screwdriver to carefully pry apart the lift housing halves. Lift the left half up and off the right half to expose the internal workings of the lift housing. (see figure below)



C. Visually inspect the lift chain (item #42 of the Lift Housing parts explosion) for damage. If the chain is okay, remove the chain-connecting link and then remove the chain to allow further disassembly and inspection of the lift housing components.

D. With the lift chain removed, the slip clutch assembly (item #23 of the Lift Housing parts explosion) can be removed by lifting it up and off the input/shaft gear assembly (item #22 of the Lift Housing parts explosion).

E. Note how the lift belt is routed inside the lift housing around the input/shaft gear assembly. Remove the input/shaft gear assembly by lifting it straight up out of the right lift housing half.

F. Release the tension spring (item #38 on the Lift Housing parts explosion) from the catch on the latch link pin (item #37 of the Lift Housing parts explosion) and then lift the upper cam assembly (items #39, #40, and #41 of the Lift Housing parts explosion) up and off the idler pin.

G. Lift the lower cam and locking pin assembly (items #34, #35, #36, and #37 of the Lift Housing parts explosion) up slightly to allow removal and inspection of the shaft/gear, clutch, and gear assembly (items #28, #29, #30, #31, #32 and #33 of the Lift Housing parts explosion).

H. Next, remove the gear/shaft and sprocket assembly (items #25, #26, and #27 on the Lift Housing parts explosion). If the lift chain and all other gears, shafts, etc… have checked okay, then the large gear molded on the shaft of the gear/shaft and sprocket assembly is slipping and needs to be replaced. (This can be verified by clamping the gear in a vise and applying moderate rotational force to the sprocket.)

I. Remove the driv lok pin and sprocket from the gear/shaft and replace the faulty part. Reassemble the sprocket and pin on a new gear/shaft.

J. Begin reinstalling the lift housing by reinstalling all gears, shafts, belts, springs, washers, clutch, and lift chain in their proper locations in reverse order of disassembly.

K. Place the left half of the lift housing back onto the right half taking care to properly position the lift belt and tube bearings (items #48 and #49 on the Lift Housing parts explosion). Be certain that the thrust washer is in the proper location (it tends to stick to the greased bushing on the opposite half of the housing - see figure above).

L. Reinstall and completely tighten the eight ¼ x 20 socket head capscrews that hold the lift housing halves together.

M. Reinstall the lift housing assembly back into the base assembly. Be sure to reinstall the lift housing with the motor mount bushing in place (item #51 of the Lift Housing parts explosion). Reattach the dampener arm (if included on the unit being serviced).

N. Reinstall all fasteners (with fresh Loctite™ where needed) and reassemble the motor mount, lift motor, encoder wheel, encoder, etc… in their proper locations in reverse order of disassembly.

O. Reinstall outer tube in lift housing base/housing assembly making sure that the lift cam end of the outer tube is toward the motor lower unit (see note of **ATTENTION** at **Step 2-C** above, regarding reassembly and proper positioning of outer tube and lift housing).

P. Reinstall control box and lower shaft collar back onto the outer tube and reattach the lift belt to the lift belt tensioning device in the control box.

Q. Reassemble the Genesis motor in reverse order of disassembly per the Internal Transducer routing procedure (per **Service Bulletin #41400**) and test for proper operation of stow/deploy, trim, and steering systems.

Case VI. With motor deployed, when the "TrimUp" foot pedal switch is pressed the lift motor "stutter / jerks" and the Genesis LCD rapidly flickers and appears to read "8A.9", and then defaults to ER6.

Step 1. Check all battery connections for proper voltage, security, and corrosion. Correct faults and retest.

Step 2. If all connections are okay, the pedal "TrimUp" switch is faulty. The foot pedal assembly (p/n 2772040) needs replacement.

A. Replace foot pedal with latest pedal from Minn Kota, and test all motor functions for proper operation.

GENESIS - AP/PD Base Housing Module

Case I. Genesis motor operates properly but LCD screen is blank, (has no display).

Step 1. Remove motor side plates and center housing to access LCD leads (see AP/PD Base/Housing parts explosion).

A. Examine the five wires connecting the LCD to the main control board.

A-1. If any of the five wires are cut, broken, or damaged, reconnect or splice back together and retest by turning Master Switch ON and observing display.

A-2. If wires check okay, but LCD does not display, the LCD is faulty and needs to be replaced.

B. Install new LCD, p/n 2224015.

B-1. Cut leads to faulty LCD and solder the leads from the new LCD in its place. (Wires are color-coded) Be sure to properly connect, solder, and seal the wire connections.

B-2. Reassemble, turn Master Switch ON, observe LCD for proper function. Test all motor operations for proper function.

Case II. If motor displays "ER6" and lift system checks out O.K., the shaft position counter may be out of place.

Step 1. Remove left sideplate of Genesis motor by removing the two-sideplate screws (item #37), and the small screw in front (item #38). See the AP/PD Base Housing parts explosion.

A. Note location of encoder wheel (item #24), and examine encoder wheel counter. (It is the small "U" shaped device with two wires attached).

A-1. Make certain that the counter is properly snapped in to place, and hold in the encoder bracket (item #25). If counter is not properly installed, it will be unable to count the revolutions of the encoder wheel and the motor will not correctly stow or deploy.

A-2. Correct any errors noted and retest motor for proper function. It may be necessary to perform the *Master Reset /Emergency Stow Procedure* to reset shaft position counter (*see page 14-21*).

GENESIS - Foot Pedal Module

****** Current Genesis foot pedals have a sticker indicating the manufacture date of the pedal (Julian date code). It is on a label on the bottom side of the pedal. Any foot pedal that does not have this label, or has the Julian date code plus "INT" (xxxxxxxINT) should automatically be replaced under warranty with a current design. This will address most of the foot pedals issues.**

Case I. When Master Switch is turned ON, the LCD briefly displays "LP" - "1.2 (hours)" then goes blank and motor will not do anything.

Step 1. Check all battery connections for proper voltage, security, polarity, and corrosion. Correct as required.

Step 2. If all connections check okay, test Master Switch by turning it part way on. Turn the switch on, but do not push the switch rocker to the full extent of its travel.

- **A.** If the LCD now stays on, displays "LP" – "1.2" then "99.9" (with the speed selector set to off) then the Master Switch is faulty and the foot pedal p/n 2772040 needs to be replaced.
- **B.** Replace foot pedal assembly with latest part from Minn Kota and test all motor functions for proper operation with new pedal.

Case II. When Master Switch is turned on the LCD briefly displays "LP/1.2 hrs" then "99.9 hrs" (with speed selector set to off), and stays on 99.9 hrs but goes blank when the mode switch is depressed.

Step 1. Check all battery connections for proper voltage, security, polarity, and corrosion. Correct any faults and retest.

Step 2. If all connections and voltage check okay., retest Master Switch by turning switch part way on and then depressing mode switch to deploy motor.

- **A.** If unit now deploys and LCD stays on, the Master Switch is intermittent and the foot pedal p/n 2772040 needs to be replaced.
- **B.** Replace foot pedal assembly with latest part from Minn Kota and test all motor functions for proper operation with new pedal.

Case III. When in "AutoPilot" mode and/or when MOM/CON switch is in the "Constant On" position, the right momentary steer button is intermittent, delayed, or does not respond.

Step 1. Check for proper right and left steering function with heel/toe pedal.

Step 2. If Genesis motor steers right and left with pedal and with constant/momentary switch in the momentary position, the left and right steering buttons work.

- **A.** The foot pedal p/n 2772040 is faulty and must be replaced.
- **B.** Replace foot pedal assembly with latest part from Minn Kota and test all motor functions for proper operation with new pedal.

Case IV. Fine adjust knob on foot pedal "slips" in one or both directions when attempting to make minor speed changes.

Step 1. Drive belt for fine adjust knob is slipping.

- **A.** Replace fine adjust pulley p/n 2222310 (item #21 on Genesis Foot Pedal Module parts explosion).
  - **A-1.** Disassemble foot pedal by removing the nine screws holding the pedal base and housing together. Note that the housing and base also snap together by means of four catches/tangs that extend through the foot pedal base to the underside.
  - **A-2.** Release the four tangs and separate the top and bottom housing and base.
- **B.** Replace the fine adjust pulley (item #21, p/n 2222310) with the latest part from Minn Kota.
  - **B-1.** Test for proper fine adjust operation and reassemble top and bottom housing and base.
  - **B-2.** Retest for proper fine adjust function after reassembly.
    to reset the shaft position counter.

Case V. Genesis motor steers right and left with momentary steering buttons but does not steer with heel/toe pedal.

Step 1. Check foot pedal heel/toe potentiometer shaft. (Foot pedal potentiometer shaft is visible between the left side of the heel/toe pedal and top housing).

- **A.** Potentiometer shaft is white, approx. 1/8" in diameter and should extend from base to pedal. If shaft is broken, heel/toe steering will not function.
- **B.** Replace foot pedal assembly p/n 2772040 with latest part from Minn Kota and test for proper operation of all motor functions with new foot pedal.

Case VI. Genesis heel/toe pedal is too loose or too tight when attempting to steer the motor right and left.

Step 1. Locate the tension adjust linkage bar on the underside of the heel/toe pedal.

- **A.** If pedal is too tight, loosen the steering pedal tension screw, (item #38, p/n 2223412 on Genesis Foot Pedal parts explosion).
- **B.** If pedal is too loose, tighten the steering pedal tension screw.

Step 2. Test for proper operation and "feel" per customer preference.

Case VII. ON/OFF switch on Genesis heel/toe steering pedal is inoperative.

Step 1. Replace foot pedal assembly p/n 2772040 with latest part from Minn Kota and test all functions for proper operation with new pedal.

Case VIII. With motor deployed, when the "TrimUp" switch is pressed the lift motor "stutter / jerks" and the Genesis LCD rapidly flickers and appears to read "8A.9", and then defaults to ER6.

Step 1. Check all battery connections for proper voltage, security, and corrosion. Correct any faults and retest.

Step 2. If all connections check O.K., the foot pedal "TrimUp" switch is faulty and the foot pedal assembly (p/n 2772040) needs to be replaced.

- **A**. Replace foot pedal with latest pedal from Minn Kota, and test all motor functions for proper operation.

GENESIS - To Re-Orient Steering Potentiometer to Motor Position

It will be necessary to Re-Orient the Steering Potentiometer to the Motor Position in the following circumstances:

- **Lower unit has been forced to turn (steering clutch slipped) more than one full turn from its original position (LCD will display ER3)**
- **if motor has been taken apart and the steering potentiometer was turned out of position when the motor lower unit was removed from outer tube (possibly while routing transducer)**
- **if steering potentiometer board has been replaced**

Step 1. If motor is stowed, note if motor is stowed in the left or right "park" position (direction of prop) and proceed to **Step 2** below.
If motor is deployed, turn Master Switch OFF and place the motor lower unit in-line with the bowmount / base housing with the prop towards you when looking straight at the LCD. (NOTE: you may need to forcefully turn the motor by hand to place it in this position.)

Step 2. With the Master Switch OFF and the control box cover removed to expose the Genesis primary gear and potentiometer belt:

A. Slip the belt off the primary gear and steering potentiometer gear. Turn steering potentiometer counter clockwise to its rotational stop.

B. From the rotation stop, turn the potentiometer exactly five complete turns clockwise and slip the belt back onto the steering potentiometer and primary gear without turning the steering potentiometer or lower motor assembly out of position.

C. Turn Master Switch ON and deploy motor (if stowed), to test steering function.

Step 3. Press and hold the Mode Switch down for two seconds to initiate the stow sequence.

A. If motor does not turn and position itself in the park left/right position (motor MUST be at a 90º angle to the bowmount / base housing to properly stow), stop the stow sequence by pressing and releasing any foot pedal switch.

B. Turn Master Switch OFF. Slip the steering potentiometer belt off the primary gear and steering potentiometer.

C. With the belt removed, physically rotate the lower unit into the proper park position (steering clutch will slip). Then place the steering potentiometer belt back onto the primary gear and steering potentiometer taking care not to move the potentiometer from its current position.

Step 4. Turn Master Switch ON and press the TrimDown button to fully deploy the motor. When the LCD again displays the hours-running time - press and hold the Mode Switch for 2 seconds to initiate stow sequence.

A. Observe that the motor now rotates into the park position for proper stowing.

B. If motor is properly aligned (at a 90º angle to the bowmount / base housing), the steering potentiometer is now properly oriented to the motor lower position and is ready for reassembly.

C. If the motor is not properly aligned, repeat **Step 3B** and **3C** until motor is rotating into position and properly stowing when the Mode Switch is pressed.

D. If, after re-orienting the steering potentiometer to motor position, the motor lower unit rotates more than one full rotation and again displays ER3, it will be necessary to reprogram the left and right park position values into the control board (*see Control Board Initial Programming Procedure, page 14-27*).

GENESIS - Lower Shaft Collar

Case I. Lower shaft collar has vertical crack or is broken at leading edge/pointed end.

Step 1. Consult Genesis Transducer Routing Procedure, Parts I, II, III, and IV of **Service Bulletin #41400**).

A. Disassemble Genesis motor as outlined in Transducer Cable Routing Procedure.

A-1. After disassembling the motor to the point listed at Part IV, Step 1, remove the four screws (p/n 2221301) that attaches the lower belt clamp and belt to the 2221501 lower outer shaft collar.

A-2. Replace the broken collar with the new improved part. Note: Be sure to attach lift belt in the same position and manner it was attached prior to disassembly.

B. Reassemble the Genesis motor in reverse order of disassembly, making certain that the anti-rattle bushing in the outer shaft stays in its proper place.

B-1. Visually confirm this by checking for the anti-rattle bushing detent catch in the hole provided in the belt channel of the outer shaft. (see below)
(On 45" shaft models, the cam profile will extend over the hole in the tube when motor is fully assembled.)

C. After reassembling Genesis motor, connect to proper voltage. Deploy the unit and test for proper function.

Genesis - Master Reset / Emergency Override

This Master Reset / Emergency Override procedure is required in the following circumstances:

- **to reset the shaft position counter (especially if the lift belt was loose or slipped)**
- **to stow the motor in the case the motor becomes stuck in the deployed position**
- **the steering motor tries to run when the motor is fully stowed**
- **the prop spins when the motor is fully stowed**
- **the LCD shows "Use Trim" when the motor is fully stowed**
- **is the first thing to try whenever something "peculiar or unexpected" occurs**

Please read this entire procedure prior before performing the Master Reset so that you understand the important notes in Step 5!

Master Reset Steps (left sideplate should be in place over the counter/wheel)

Step 1. Turn the Master Switch OFF.

Step 2. Simultaneously press and hold Mode Switch while turning the Master Switch ON.

Step 3. Continue to hold Mode Switch (LCD should be displaying "**---**"; if not, then you probably momentarily released the Mode Switch – restart procedure) until the LCD shows "Sto" (approximately 15 seconds for earlier software versions and approximately 5 seconds for software version #107).

Step 4. Release Mode Switch

Step 5. ***Important (if motor is stowed):*** The motor will be trying to steer (you should be able to hear the steering motor running). Quickly press either of the momentary steering arrow buttons to disengage the steering system. If you do not disengage the steering system within 5 seconds you may overheat and damage the steering motor! Also, you may get an ER5 code after completing **Step 7** below. Simply turn off the Master Switch. The next time you turn it back on the ER5 code will be cleared.
Important (if motor is deployed): In some situations the motor may be steering in circles, quickly press either of the momentary steering arrow buttons to disengage the steering system. Use the momentary steering arrows to orient the lower unit perpendicular to the mount. The lower unit can also be rotated by hand, ratcheting / slipping the steering clutch.

Step 6. Use the TrimUp Switch to stow the motor. Release the TrimUp when the unit is fully stowed.

Step 7. Press and release Mode Switch to reset the system (at this point the LCD display should have switched from "Sto" to the hour meter reading), and then turn the Master Switch OFF.

GENESIS – Identifying Software Version Code

Step 1. Check to ensure proper voltage and polarity at battery (Genesis 55=12v, Genesis 74=24v).

Step 2. Turn the Master Switch (located on side of foot pedal) ON.

Step 3. Turn the speed control knob on the foot pedal so that it reads 100 (full speed).

Step 4. While watching the LCD, turn Master Switch OFF. The software version will flash momentarily on the LCD, just before the LCD screen goes blank.

Step 5. If the software version shown is number **102** or less, the main power control board will need to be replaced (*page 14-25*), reprogrammed (*page 14-27*), and recalibrated (*page 14-29*).

GENESIS – Steering Potentiometer Testing & Replacement

Case I. If motor LCD defaults to ER4 or steering potentiometer has been damaged/turned past its rotational stop.

Step 1. Remove control box cover and center housing for the LCD. Inspect the bullet connections from the coil cord to the potentiometer board and from the coil cord to the main control board.

A. Correct any questionable connections and retest motor operation.

Step 2. Check to ensure that the steering potentiometer belt is in place on the primary gear and steering potentiometer.

Step 3. If belt is in place, make sure Master Switch (on foot pedal) is OFF. Then remove the belt, mark the potentiometer pulley, and test the potentiometer.

A. The steering potentiometer should rotate smoothly without any catching or "rough" spots, until it comes to the rotational stop. (NOTE: the steering potentiometer is a 10-turn pot).

B. If any "rough" spots or catching occurs, replace the potentiometer board as instructed in **Step 4** (below).

C. If the potentiometer rotates smoothly, using a good-quality, digital multi-meter test for the following resistances:

C-1. The resistance across the potentiometer (pot) to the pot board should be 5K ohm (+/- 5%).

C-2. With the potentiometer centered (5 turns from either rotational stop), the resistance value across the blue and red or blue and green wires should be 2.5K ohm (+/- 5%).

C-3. With the potentiometer shaft turned counter-clockwise to the rotational stop, the resistance across the red and blue wires should be 0. As the pot shaft is turned clockwise, the resistance should gradually increase until at the end of the clockwise rotation (10 turns), the resistance should be 5K ohm (+/- 5%).

C-4. Replace the steering potentiometer if the pot does not test to the above specifications.

D. If the steering potentiometer tests fine, re-orient Steering Potentiometer to Motor Position (*see page 14-19*).

E. Check the coil cord for continuity (replace if necessary).

Step 4. To replace the steering potentiometer board; disassemble the Genesis motor per Parts I, II, and III of Transducer Routing Procedure (**Service Bulletin #41400)** stopping at Step 2 of Part III.

A. Remove the four screws holding the steering chassis to the lower control box. (See Genesis Steering Module parts explosion).

A-1. Lift steering chassis out of the control box and turn it over to access the steering motor retaining screws, p/n 2223427. (See parts explosion).

A-2. Remove the three screws that hold the steering motor onto the underside of the steering chassis.

B. Disconnect the leads connecting steering chassis potentiometer board and steering motor to coil cord wires.

C. Loosen the potentiometer pulley setscrew (item #51 of the Steering Module parts explosion) and remove the potentiometer gear/pulley.

F. Unscrew the nut that holds the steering potentiometer into the steering chassis/mounting plate assembly (item #19 of the Steering Module parts explosion).

G. Remove the steering potentiometer circuit board from the steering chassis by carefully prying outward on the board retaining fingers.

H. Install the replacement steering potentiometer board and potentiometer. (**NOTE:** the steering potentiometer must be inserted into the steering chassis with the potentiometer leads toward the outside edge of the chassis and with the small locating pin on the potentiometer inserted into the hole provided in the steering chassis. Failure to position the locating pin in this hole will result in damage to the new potentiometer when the potentiometer nut is tightened!)

I. Reassemble the steering motor and steering chassis. Reattach all wires in their proper locations, install potentiometer pulley on potentiometer, and reassemble the steering chassis assembly in the control box. Reinstall primary gear, gear collar, and primary gear screws (using Loctite^{tm} #603 on the screws).

J. Re-Orient the new steering potentiometer to motor lower unit (*see page 14-19*).

GENESIS – Control Board Replacement

The Genesis main control board should only be replaced if:

- **the control board has failed**
- **the control board installed in the motor has been identified as having early or outdated software** (*see page 14-22*)

Control board replacement on a Genesis motor is a complex procedure and, as such, should never be done unless the warranty repair center knows for certain that replacement is necessary.

Main Control Board Replacement (Motor may be either stowed or deployed)

Step 1. Disassembly

A. Remove the Genesis left and right sideplate retaining screws and then remove the sideplates.

B. Remove the center display housing (item #33 on the Base/Housing parts explosion) by pushing in on the retaining tabs to expose the Genesis main control board assembly.

C. Remove the 2 screws (item #34 on the Base/Housing parts explosion) to separate the LCD from the center housing.

D. Remove the strain relief bracket screw and bracket (item #14 and #13 on the Base/Housing parts explosion) from the base extrusion.

E. Disconnect the coil cord wires, lift housing lead wires, and battery leads from the control board. **NOTE:** if the motor being serviced is a non-AutoPilot motor go to **Step 1-G**.

F. Lift the AutoPilot compass assembly up and off the compass-mounting bracket.

G. Lift the shaft position encoder out of the encoder bracket (item #25 on the Base/Housing parts explosion).

H. Remove the 4 screws that hold the control board into the base extrusion.

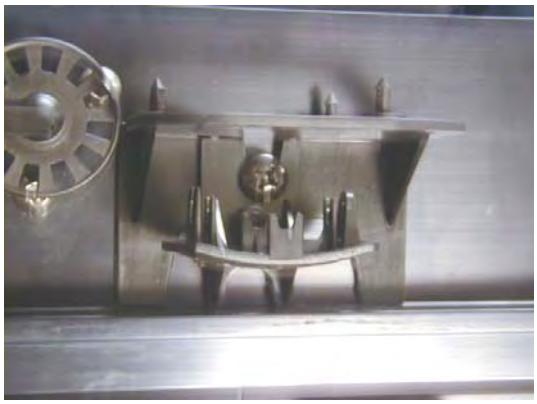
I. Lift the control board out of the base extrusion.

Step 2. Reassembly

A. Place the new control board in the base extrusion.

B. Reconnect all wiring (refer to wiring diagram with new control board). Reinstall the strain relief on the battery lead wire and the control board's plug wire. If the motor being serviced is a non-AutoPilot go to **Step 2-E**.

C. When replacing the main control board on a Genesis *AutoPilot* motor, install the compensating magnet bracket and magnet rods (p/n 2881937) which is included with the new AutoPilot control board assembly (early units did not utilize compensating magnets). See figure below. *(If you order the older control board by the old p/n 2224011 for 12-volt units or p/n 2224013 for 24-volt units, it will sub to a kit that has everything needed. If you order the control board by the current part numbers, p/n 2224014 for 12-volt units or p/n 2224016 for 24-volt units, you will not receive the compensating magnet bracket and magnet rods).*



C-1. To install the compensating magnet bracket remove the compass bracket screw, (item #32 on the Base/Housing parts explosion) and position the compensating magnet bracket in place below the AutoPilot compass-mounting bracket. Reinstall the bracket screw to hold both the compass bracket and the compensating magnet bracket in place. **Do not install the 2 magnet rods at this time!**

D. Install the compass assembly on the compass bracket (re-use the orange grommets from the old compass).

E. Install the encoder (writing on the encoder to face up) and LCD in their places. Reinstall the center display housing/LCD and *right* sideplate.

F. Proceed to the "**Initial Board Programming Procedure"** (*page 14-27*).

GENESIS – Control Board Initial Programming Procedure

We recommend that you have (and use) the specially modified *Genesis Test Foot Pedal*, p/n 2772040T, when doing this procedure.

NOTE: These steps should not be done in bright sunlight or under bright fluorescent lighting with the left sideplate (covers the encoder) removed. The bright light can give false information to the encoder.

Initial Programming Steps (Motor must be connected to appropriate voltage)

Step 1. Readying the motor for Initial Control Board Programming

- **A.** Perform the complete *Master Reset / Emergency Stow Procedure* to set the shaft position counter (*see page 14-21*).
- **B.** Turn the Master Switch back ON.
- **C.** Deploy the motor by pressing the Mode Switch.
- **D.** Turn the Master Switch OFF.

Step 2. Setting Left and Right Park Positions

- **A.** Using the test foot pedal (p/n 2772040T), press and hold both the TrimUp and TrimDown buttons while turning the Master Switch ON, then release both trim buttons.
- **B.** LCD display on motor should read "LFT".
  - **B-1.** If LCD shows *"SET PROPELLER"* turn pedal OFF and return to **Step 1** above.
  - **B-2.** If LCD shows *"SET STRAIGHT AHEAD"* then both TrimUp and TrimDown buttons were not pushed simultaneously. Turn pedal off and return to **Step 1** above.
- **C.** Use momentary steering switches to place motor lower unit in propeller left park position. (Left park position is motor lower unit at a 90 º angle to the Genesis base housing with the prop pointing to the left when viewing the LCD.)
- **D.** Using care not to adjust the footpedal (rocker) steering position, press the "Momentary ON" switch located on heel/toe steering pedal once to enter this setting into the main board "memory".
- **E.** LCD on motor should now read "Rt".
- **F.** **NOTE: In this step, the motor lower unit must be rotated counterclockwise (when looking down at the motor lower unit).** Use the Left Momentary Steering Switch to rotate motor lower unit from left park position to right park position. (Right park position is motor lower unit at a 90 º angle to the Genesis base housing with the prop pointing to right when viewing the LCD.)
- **G.** Using care not to adjust the footpedal (rocker) steering position, press "Momentary ON" switch located on the heel/toe steering pedal once to enter this setting into the main board memory. (Note: if the left and right park positions are already set correctly, the TrimUp switch may be pressed to skip or "toggle" through this portion of the procedure.)

Step 3. Setting Shaft Length (after completing **Step 2** the shaft length setting will automatically display)

- **A.** LCD on motor should read 45, 52, or 60 if properly set to match the motor shaft length. (The memory will default to 45 on a newly installed main board.)
- **B.** Use the right momentary steering switch to "toggle" through the shaft lengths until the correct shaft length for the motor is displayed (45, 52, or 60).
- **C.** Press "Momentary ON" switch located on the heel/toe pedal once to enter this setting into the main board memory. (NOTE: if the shaft length is already set correctly, the TrimUp switch may be pressed to skip or "toggle" through this portion of the procedure.)

Step 4. Setting Lift Motor Condition (after completing **Step 3** the motor lift condition setting will automatically display)

A. Display should read either “up” or “dn”. (The display will show last setting selected. On a newly installed board the LCD will default to “dn”.)

B. Press “Momentary ON” switch located on the heel/toe pedal once to enter this setting into the main board memory.

Step 5. Selecting the Offset Table (after completing **Step 4** the Offset Table will automatically display)

A. The LCD on motor will display “OF0”, “OF1”, or “OF2”. (The display will show last setting selected.)

B. Press and release the right momentary steering switch to select offset table “**OF0**”.

C. Press “Momentary ON” switch (located on the heel/toe pedal) once to enter this setting into the main board memory.

Step 6. After completing **Step 5**, the LCD on the motor will display “**---**”

A. Turn Master Switch OFF to “lock” all steps of this procedure in main board memory and to return motor to normal operating mode.

B. If unit is a non-AutoPilot model, this step completes the Initial Programming Procedure.

B-1. Test unit for proper operation. Service completed.

C. If the motor being serviced is an AutoPilot model, proceed to the “**Calibrating AutoPilot Compass Software Procedure**” (*page 14-29*).

GENESIS – Calibrating AutoPilot Compass Software

This procedure should only be used:

- **After replacing the main control board/compass assembly**
- **When adding the compensating magnet rods and bracket to earlier units without them**

We recommend that you have (and use) the specially modified *Genesis Test Foot Pedal*, p/n 2772040T, when doing this procedure.

Calibrating AutoPilot Compass Software Steps (Motor must be connected to appropriate voltage and be **DEPLOYED** for the following procedure and test)

Step 1. Calibrating Compass Software (Note: steering functions will be inactivated during this step) Using the Genesis Test Pedal, p/n 2772040T, press and hold down the TrimUp, TrimDown, and the right momentary steering switches while turning the Master Switch ON.

A. Release TrimUp, TrimDown, and right momentary switches.

B. LCD should only display the AutoPilot icon. (If the icon is flashing, the motor is trimmed up too high and will not allow the AutoPilot feature to operate. Use TrimDown switch to lower motor, then reactivate the AutoPilot feature by pressing the mode switch once.)

C. Temporarily place the left sideplate in position to cover the compass unit and to block UV light that could affect the compass sensors. Note: earlier sideplates must be notched out as shown in the diagram below to clear the compass magnet bracket.

D. With the motor on a rotatable stand, rotate the entire motor and base extrusion one complete revolution from the starting point, and then rotate it back to the starting point (360° CW, then 360° CCW). Rotate the unit slowly, 360° in about 15 seconds. Be sure that no large ferrous-metal objects are nearby when doing this step.

E. Press "Momentary ON" switch located on the heel/toe pedal once to enter this setting into the main board memory, "---" should be displayed on the LCD. Turn Master Switch OFF.

Step 2. Installing the Compensation Magnet Rods

A. Remove the sideplate that was temporarily placed over the compass assembly to block the UV light interference.

B. Install the N-S (North-South) compensating magnet rod first, positioning the rod with the screwdriver slot outward and slot parallel to the mounting base/horizon.

C. Install the E-W (East-West) compensating magnet rod with the screwdriver slot outward and the slot parallel to the mounting base/horizon. (The E-W rod will snap down into place and this will hold the N-S rod in place.) **NOTE: With the N-S and E-W screwdriver slots parallel to the base/horizon, the compensating magnet rods are in the neutral position and the AutoPilot is ready for testing and fine adjustment.**

Step 3. Testing / Adjusting AutoPilot Accuracy

NOTE: When performing these steps place a "shop rag" on the compass assembly. Sunlight or bright fluorescent lighting can over-power the compass' optical sensors.

A. Turn Master Switch ON.

B. With the motor on rotatable stand, point motor base extrusion and lower unit to the north (LCD to the south).

C. Press and release the Mode Switch once to turn AutoPilot ON. (Note: do not hold the Mode Switch down for more than 2 seconds or the motor will stow.) The **AutoPilot** icon will display on the LCD above the hours-running time. (If the icon is flashing, the motor is trimmed up too high and will not allow the AutoPilot feature to operate. Use TrimDown switch to lower motor and reactivate the AutoPilot feature by pressing the mode switch once.)

D. Rotate the motor base extrusion (and stand) slowly to the NW (LCD to the SE). Observe motor lower unit. The lower unit should still point north with an error of less than 20º. If error is greater than 20º, adjust the N-S compensating magnet rod as needed with a non-magnetic screwdriver to reduce the amount of error.

E. Rotate the motor base extrusion (and stand) to the NE (LCD to the SW), and observe motor lower unit. The lower unit should still point north with an error of less than 20º. Adjust the N-S compensating rod as needed with a non-magnetic screwdriver to reduce the amount of error.

E-1. Rotate the motor base extrusion (and stand) back to the north (LCD to the south). Observe motor lower unit to confirm that the amount of error when pointing north is less than 20º. Repeat **Steps 3D & 3E**, if needed.

F. Rotate the motor base extrusion (and stand) to the west (LCD to the east). Steer the lower unit so it points to the west using the left/right momentary steering buttons (AP function still engaged).

G. Rotate the motor base extrusion (and stand) slowly to the SW (LCD to the NE). Observe motor lower unit. The lower unit should still point west with an error of less than 20º. If error is greater than 20º, adjust the E-W compensating magnet rod as needed with a non-magnetic screwdriver to reduce the amount of error.

H. Rotate the motor base extrusion (and stand) to the NW (LCD to the SE), and observe motor lower unit. The lower unit should still point west with an error of less than 20º. Adjust the E-W compensating rod as needed with a non-magnetic screwdriver to reduce the amount of error.

H-1. Rotate the motor base extrusion (and stand) back to the west (LCD to the east). Observe motor lower unit to confirm that the amount of error when pointing west is less than 20º. Repeat **Steps 3G & 3H**, if needed.

I. If AutoPilot functions properly and tests within the limits specified in **Steps 3-D** through **3-H**, place a drop of super glue on the E-W compensating magnet rod support to lock it in place. Install the modified/notched sideplate taking care not to bump or move the compensating magnet rods out of position.

J. Test the AutoPilot function with the sideplate in place (over the compass).

J-1. If it tests within the limits specified in **Steps 3-D** through **3-G** this procedure is completed.

J-2. If the motor does not test within these limits, adjust the compensating magnet rods until the AutoPilot tests fine (i.e. repeat **Step 3**, above).

Step 4. Spin the base of the motor a complete revolution and ensure the internal compass card is spinning freely (not “hanging up” or sticking in any direction).

Step 5. Early Genesis models did not have compensating magnets under the compass assembly. We recommend installation of the compensating magnets and bracket assembly (p/n 2881937).

Step 6. Recalibrate AutoPilot Compass Software as outlined on pages 14-29 and 14-30. (Note: do not install the magnet rods until the procedure instructs you to do so.)

GENESIS – AutoPilot Steering Malfunction

Case I. AutoPilot turns itself off while operating in AutoPilot mode.

Step 1. Determine if motor may have been trimmed too high while running in AP mode.

- **A.** The AutoPilot icon will flash if the motor is trimmed too high. This indicates that the AP feature has turned itself off due to magnetic interference from lower unit on the AP compass.
- **B.** Trim the motor down, and then press the "Mode Switch" once to reactivate the AP function.

Step 2. If the AP function turns itself off while in operation:

- **A.** Any interruption in power to the motor will disengage the AP system. Check battery leads, plug, wire connections, etc… as motor power leads may have an intermittent connection. Customer should be informed of the possibility of voltage interruption stemming from power supply in boat (breaker kicking off then back on, etc…).

Case II. Jerky AutoPilot steering.

If, while holding a heading, the AP motor steering system seems to "jerk" back and forth a few degrees it may be due to excessive gear "lash" or looseness in the steering gear system.

Step 1. To dampen this oscillation of the motor lower unit, make sure that the 2-piece aluminum stop collar on the motor shaft (between the lower shaft collar and motor bung) is firmly slid up against the lower shaft collar bushing and tightened in place.

Step 2. If problem persists, install new steering clutch gear system and steering motor output gear (p/n 2770215).

Step 3. Refer to "Calibrating AutoPilot Compass Software" **Step 3** (*page 14-29*).

Case III. Motor steers fine in manual mode, but does not steer in AP mode.

Step 1. Verify the motor is an AP model and the LCD AutoPilot icon is displayed.

Step 2. The sideplate must be in place (covering the compass) as a bright fluorescent light or sunshine can overpower the compass' optical sensors and inhibit AP steering.

Step 3. Make sure motor is mounted within 5 degrees of level and there is no ferrous metal object near the motor that is affecting normal compass operation.

Step 4. Ensure the compass assembly is fully snapped in place and seated on the compass bracket (compass is setting level and able to spin freely).

Step 5. Spin the base of the motor and ensure the internal compass card is spinning freely.

Step 6. If all the above steps test okay, replace main control board assembly.

Case IV. AutoPilot function is erratic (doesn't maintain proper headings).

Step 1. The sideplate must be in place (covering the compass) as a bright fluorescent light or sunshine can overpower the compass' optical sensors and inhibit AP steering.

Step 2. Make sure motor is mounted within 5 degrees of level and there is no ferrous metal object near the motor that is affecting normal compass operation (including the compass bracket screw).

Step 3. Ensure the compass assembly is fully snapped in place and seated on the compass bracket (compass is setting level and able to spin freely).

Chapter 15.

Manufactured between 1996 - 2002

PowerUp Lifts, Trims, and Tilts

Case I. PowerUp Models MKN 5100 & MKN 5300 do not lift/tilt

(serial number prefix MKJG and later)

Step 1. Check for proper voltage and good battery connections at leadwire.

Step 2. Check connections from UP/Down push button switch to replay harness (3 wire plug)

- **A.** Locate relay in relay harness assembly. Actuate UP/DOWN push button switch, you should hear the relay click as this is being done.
- **B.** Isolate and disconnect leads from relay harness to lift motor.
- **C.** With the UP/Down push button switch actuated, a V.O.M. should show battery voltage across relay harness motor leads. If no voltage is noted, relay harness needs to be replaced. If voltage is noted, go to **Step 3**.

Step 3. Apply 12 volts directly to lift motor terminals, reverse polarity to reverse motor rotation.

- **A.** If motor fails to run, the motor is bad and needs to be replaced.

Case II. PowerUp Models MKN 5400 & MKN 5500 do not lift/trim

(serial number prefix MKJG and later)

Step 1. Check for proper voltage and good battery connections at leadwire.

Step 2. Check connections from UP/Down push button switch to replay harness (3 wire plug)

- **A.** Locate relay in relay harness assembly. Actuate UP/DOWN push button switch, you should hear the relay click as this is being done.
- **B.** Isolate and disconnect leads from relay harness to lift motor.
- **C.** With the UP/Down push button switch actuated, a V.O.M. should show battery voltage across relay harness motor leads. If no voltage is noted, relay harness needs to be replaced. If voltage is noted, go to **Step 3**.

Step 3. Apply 12 volts directly to hydraulic pump motor, reverse polarity to reverse pump motor rotation.

- **A.** If pump motor fails to run, pump motor assembly needs to be replaced. (For units with MKJG serial number prefix, contact Minn Kota for assistance.)

Case III. PowerUp Models MKN 5400 & MKN 5500 (with serial number prefix MKJG) slowly leak down, won't stay up, or won't trim outboard when engine is in use.

Step 1. Contact Minn Kota for assistance.

Case IV. PowerUp Models MKN 5400& MKN 5500 (with serial number prefix MKJH and later) will not fully lift/tilt or "jerks" while lifting/tilting.

Step 1. Check fluid level in pump reservoir.

- **A.** Remove dipstick located in pump body between hydraulic hoses with slotted screw driver (dipstick is marked to show proper fluid level.)
- **B.** Fill with ATF (automatic transmission fluid) as required. Do not overfill!
- **C.** Test unit for proper operation.

For PowerUp models not listed here, contact Minn Kota for assistance.

Chapter 16.
Engine Mount (EM) & Neptune (EP)

This Repair Manual Chapter is divided into Part I and Part II.	
Part I. pertains to EM 2006 and later models (s/n AG and later).	**pages 16-1** through **16-2**
Part II. pertains to EP & EM motors manufactured prior to model year 2006 (s/n AF & earlier).	**pages 16-3** through **16-5**

PART I.

EM motors manufactured for model year 2006 and later (s/n AG and later).

Part I - Case I. Motor does not run.

Step 1. Check for proper voltage and polarity. Check for any corroded connections.

Step 2. Disconnect motor leads from control module and connect motor leads to 12-volt power source. (This applies to 12, 24, or 36-volt models.)

A. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, bad brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.

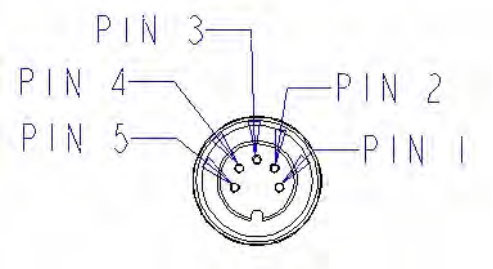
B. If motor ran when motor leads were connected directly to 12vdc, the problem is either with the hand controller or control module.

B-1. Test hand controller:

Hand Controller Test Procedure

1. Set your VOM to check for continuity. With the speed selector knob in the "OFF" position check to verify that there is no continuity across pins 1 and 3.
2. Rotate speed selector knob clockwise to the forward position, pins 1 and 3 should show continuity.
3. Rotate speed selector knob counterclockwise to the reverse position. Pins 1 and 3 should again show continuity.
4. With the speed selector knob in the "OFF" position and your VOM set to measure resistance, measure the resistance across pins 2 and 5. The resistance value should be between 950-1050 ohms.
5. Measure the resistance across pins 2 and 4. The resistance value should be between 400-600 ohms.
6. With your VOM probes across pins 2 and 4, rotate speed selector counterclockwise to full reverse. Resistance should gradually decrease to less than 2 ohms.
7. Rotate speed selector clockwise to full forward. Resistance across pins 2 and 4 should gradually increase to between 990-1000 ohms.

The hand controller is faulty if any of these steps do not match.



Plug End (Pin End View) of Hand Controller

B-2. If the hand controller tests okay, the problem is with the control module. Test control module to verify problem:
- **a.** Connect control module to appropriate power source.
- **b.** Plug in known good (tested as per above) hand controller directly to control module. Check for voltage at module output leads by hooking up test light (or motor) to control output leads. Vary the potentiometer / speed control setting. Test light (or motor) should vary with the potentiometer setting. Replace control module, as necessary.

Part I - Case II. Motor runs in one direction only.

Step 1. Check hand controller and control module plug ends pins and connector sleeves for corrosion. Clean, if needed, reconnect and test again for proper operation.

Step 2. Test hand controller per test procedure on page 16-1.
- **A.** Replace hand controller if it tests faulty.
- **B.** If the hand controller tests okay, the problem is with the control module. Test control module to verify problem:
  - **B-1.** Connect control module to appropriate power source.
  - **B-2.** Plug in known good (tested as per above) hand controller to control module. Check for voltage at module output leads by hooking up test light (or V.O.M. probes) to control output leads. Vary the potentiometer / speed control setting. Test light (or V.O.M.) should vary in intensity with the potentiometer setting. Replace control module, as necessary.

Part I - Case III. There is a gap between the propeller and the end bell housing.

Step 1. On the earliest version of the 2006 EM motors, the armatures utilized an E-ring behind the commutator to act as an end-play spacer. Sometimes the E-ring would pop off the armature shaft due to the vibration of the outboard. The later designs removed the E-ring and use a bushing placed on the armature to act as the spacer. Replace the armature with a current version.

Part I - Case IV. Twin EM motor units only (EM160 & EM202): 1 motor runs, 1 doesn't.

Step 1. On the one motor that doesn't run, disconnect motor leads from the control module and connect motor leads to 12-volt power source. (This applies to 12, 24, or 36-volt models.)
- **A.** If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, bad brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.
- **B.** If motor does run, go to **Step 2**.

Step 2. Check control module plug end pins for corrosion. Clean, if needed, reconnect and test again for proper operation. If both motors still do not run, go to **Step 3**.

Step 3. If test was done correctly, the control module could be faulty, test control module to verify problem:
- **A.** Connect control module to appropriate power source.
- **B.** Plug in hand controller to control module. Check for voltage at module output leads by hooking up a test light (or motor) to control module output leads. Vary the potentiometer / speed control setting. Test light (or motor) should vary in intensity (or speed) with the potentiometer setting. NOTE: VOM usage not recommended as it will not show a varying voltage due to pulsed/PWM output from control module. With PWM output voltage does not vary, only the length of time between "on" pulses varies. Replace control module, as necessary.

PART II.

All Neptune/EP and EM motors manufactured prior to year 2006 (s/n AF) and earlier.

Part II - Case I. Motor does not run.

Step 1. Check for proper voltage and polarity. Visually check to see that all wires are attached to proper control board terminals. Consult appropriate wiring diagram for the model and board being tested. Check for any corroded connections. Clean / rewire, if necessary.

Step 2. Disconnect motor leads from control module and connect motor leads to 12-volt power source. (This applies to 12 or 24-volt models.)

A. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, bad brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.

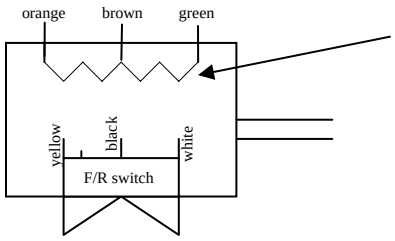
B. If motor ran when motor leads were connected directly to 12vdc, the problem is either with the hand controller or control module.

B-1. Test hand controller:

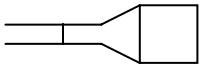
Hand Controller Test Procedure

The test procedure for the hand controller is performed with your V.O.M. set on the *Resistance x 1* scale.

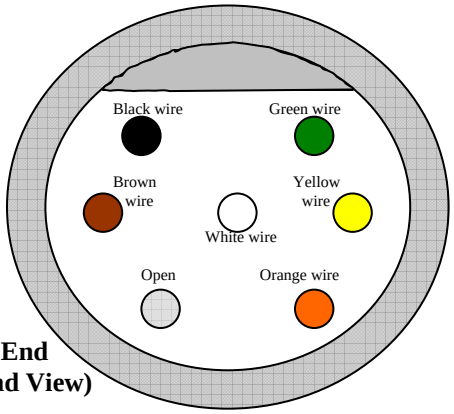
1. With the speed control @ zero, across the brown and green pins you should have approximately 1-2 ohms. As the speed control is turned, the resistance will gradually increase to 1K.
2. With the F/R switch in the Forward position, you should see continuity across the black and white wire pins.
3. With the F/R switch in Reverse, you should see continuity across the black and yellow wire pin locations.



Hand Controller



Plug End



Plug End (Pin End View)

B-2. If the hand controller tests okay, the problem is with the control module (or "Y" splitter). Test control module(s) to verify problem:

C. Connect control module to appropriate power source (12vdc for EM42, EM44, & EP42 – 24vdc for EM48, EM54, EM96, EP48, EP96, & EP130).

D. Plug in known good (tested as per above) hand controller directly to control module (bypass / remove "Y" splitter from circuit if motor is an EM96, EP96, or EP130 and check each control module individually).

E. Check for voltage at module output leads by hooking up test light (or V.O.M. probes) to board output leads. Turn hand controller ON to either F or R and vary the potentiometer / speed control setting. NOTE: all EM control modules and early EP modules, (EPs produced prior to 1999), utilize a motor disconnect relay in the output circuit of the module. On modules with the disconnect relay, test for output voltage directly at the board output terminals and at the output leads that connect to the motor unit. Testing in this manner will determine if the disconnect relay is good or defective.

E-1. If there is no output voltage at board terminals, the control board is defective. Replace control board or module, as needed.

E-2. If board terminals have output voltage, but there is no output at the leads that connect to the motor, the disconnect relay is faulty and needs to be replaced.

F. If motor is an EM96, EP96, or EP130, test second control module. If both modules test fine, problem is in the "Y" splitter cable. Replace "Y" cable, as needed.

Part II - Case II. Motor runs in one direction only.

Step 1. Check hand controller and control module plug ends pins and connector sleeves for corrosion. Clean, if needed, reconnect and test again for proper operation.

Step 2. Test hand controller Forward, Off, and Reverse switch for proper operation and check continuity through switch per hand controller test procedure on page 16-1.

A. If faulty switch is found, replace hand controller.

B. If switch tests okay, problem is with control module. Replace module control board or module assembly, as needed.

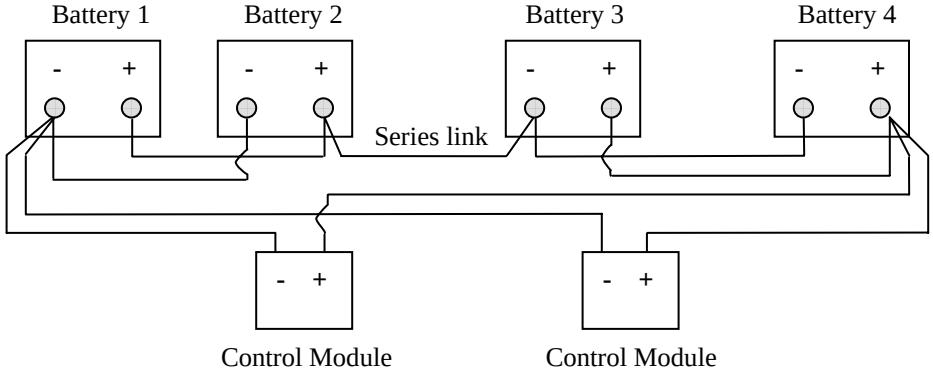
Part II - Case III. EM 96, EP96/130 twin motor units: only 1 motor runs

Step 1. On the one motor that doesn't run, disconnect motor leads from the control module and connect motor leads to 12-volt power source. (This applies to 12 or 24-volt models.)

A. If motor does not run, the problem is in the motor lower unit. Disassemble and check lower unit for voltage at the brushes, water in lower unit, worn brushes, bad brush springs, or an open or shorted armature. Repair/replace parts as necessary. Test motor for proper operation.

B. If motor does run, go to **Step 2**.

Step 2. If using four 12vdc batteries to power twin EM or EP models, check to make sure that both modules are connected to the same power source. For proper operation, batteries 1 &2 should be connected in parallel, next connect batteries 3 & 4 in parallel. Then series connect the two banks of paralleled batteries. The battery leads from both modules are then connected to the series connected batteries. (See diagram below.)



Step 3. Check all hand controller, control module, and "Y" splitter plug end pins and sleeves for corrosion. Clean, if needed, reconnect and test again for proper operation. If both motors still do not run, go to **Step 4**.

Step 4. Disconnect "Y" splitter cable from hand controller and control modules. Connect hand controller directly to the control module for the motor that is not operating. Test motor function.

A. If the motor that is connected to this control module operates okay, this control module is good. The problem is in the "Y" splitter cable. Replace "Y" cable, as needed.

B. If the motor that is connected to this control module does not operate, something is faulty with this control module assembly. Test the control module to determine if just the disconnect relay is defective or the control board is bad.

NOTE: all EM control modules and early EP modules, (EPs produced prior to 1999), utilize a motor disconnect relay in the output circuit of the module. On modules with the disconnect relay, test for output voltage right at the board output terminals and at the output leads that connect to the motor unit. Testing in this manner will determine if the disconnect relay is good or defective.

B-1. If there is no output voltage at board terminals, the control board is defective. Replace control board or module, as needed.

B-2. If board terminals have output voltage, but there is no output at the leads that connect to the motor, the disconnect relay is faulty and needs to be replaced.

Part II - Case IV. EP only: Trim/Tilt lift system does not operate

Step 1. Check all battery connections, plug connections, and terminal connections for corrosion and security. Clean, if needed, and test for function. The lift system must be connected to 12 volts only (per EP wiring diagram).

Step 2. Disconnect lift motor power leads from relay harness. Connect 12 volts directly to lift motor, and check for function. Reverse polarity to reverse direction of travel.

- **A.** If lift system does not function when relay harness is bypassed, the lift motor is faulty and needs to be replaced.
- **B.** If lift system functions when relay harness is bypassed, the problem is with either the relay harness or the Up/Down Switch.
  - **B-1.** Test Up/Down Switch for continuity.
  - **B-2**. If switch tests okay, replace relay harness.

Chapter 17.

DeckHand Electric Anchor

(models DH1, DH15. DH18, DH20, DH25, & DH35)

Case I. DeckHand does not lower or raise anchor

Step 1. Check to ensure proper voltage. Inspect battery connections and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Check to see if lift motor works by applying 12 volts directly to lift motor leads (bypass all the existing wires and switches).

A. If motor runs fine, go to **Step 3**.

B. If motor does not run, replace lift motor (P/N 2887800). Test unit for proper operation.

C. If motor can be heard running, but the rope spool does not spin, remove the gear motor from the side of the base. Remove the housing cover gasket so that you can inspect the drive gear (P/N 350-154).

C-1. If the drive gear is cracked, broken, or the teeth are stripped, replace drive gear (grease new gear liberally with wheel bearing grease). Reassemble unit and test for proper operation. **NOTE:** If new gear seems very tight, you may need to ream out the center hole of the gear with a 21/64" drill bit.

C-2. If drive gear looks good, remove gear to inspect the armature/worm shaft. If worm shaft is broken, replace entire gear motor. Reassemble and test unit for proper operation.

Step 3. Check for continuity through the automatic reset circuit breaker which is located in the positive (+) lead wire between the battery and the UP / DOWN switch. The circuit breaker is defective if no continuity is noted. Replace circuit breaker and test unit for proper operation.

Step 4. Disassemble the UP / DOWN switch housing and inspect all connections at the switch terminals for security.

A. After going through all the above steps, the UP / DOWN switch must be defective. Replace switch and test unit for proper operation.

Case II. DeckHand does not have enough power to lift anchor (you need to help by pulling up and "feeding" rope into winch as it lifts)

Step 1. Check to ensure proper voltage. Inspect battery connections and any butt splice connections in battery leadwire for corrosion and security.

Step 2. Check for proper voltage to motor while DeckHand is under load. Use of adequate gauge wire in boat or any leadwire extension is critical to avoid voltage drop / low voltage to the motor. Inadequate wiring or corroded plug / plug receptacle connections can result in considerable voltage loss and poor performance.

Step 3. Possible problem with the drive gear (P/N 350-154) in the gear motor. Remove the gear motor from the side of the base. Remove the housing cover gasket so that you can inspect the drive gear (P/N 350-154).

A. If the drive gear is cracked, broken, or stripped, replace drive gear (grease new gear liberally with wheel bearing grease). Reassemble unit and test for proper operation. **NOTE:** If new gear seems very tight, you may need to ream out the center hole of the gear with a 21/64" drill bit.

Case III. DeckHand lowers anchor then immediately lifts anchor (or vice versa)

Step 1. Possible knot in rope on spool. If the rope is caught by a knot or part of the rope is buried in the layered wrappings of the rope, the spool will be turning the proper direction, but the rope will reverse when it catches the knot.

A. Remove cover from DeckHand base.

B. "Feed out" rope from spool while watching for knots and/or the rope being buried underneath other layers.

B-1. Re-adjust rope on spool, as needed.

Case IV. DeckHand lifts anchor when you push "DOWN" switch and lowers when you push "UP"

Step 1. Check to ensure proper polarity at the battery and at the Up/Down switch (polarity may be reversed).

Step 2. Possible knot in rope on spool. If the rope is caught by a knot or part of the rope is buried in the layered wrappings of the rope, the spool will be turning the proper direction, but the rope will reverse when it catches the knot.

A. Remove cover from DeckHand base.

B. "Feed out" rope from spool while watching for knots and/or the rope being buried underneath other layers.

B-1. Re-adjust rope on spool, as needed.

Case V. Deckhand will lift anchor, but not deploy the anchor.

NOTE: When the UP / DOWN switch is in the Down position, the anchor rope must have tension applied in order for the motor to run (play out rope), as the rope tension actuates the momentary switch P/N 2374010.

Step 1. Possible defective momentary switch (P/N 2374010)

A. Remove spool and test with finger by actuating button

Step 2. Spool bearing (P/N 2370000) may be installed incorrectly. The spool bearing must be free to move forward and back to actuate the momentary switch.

A. If the spool bearing cannot move back and forth, remove rope spool and rope guide from DeckHand base. Remove the spool bearing, rotate it 1/4 turn, and reassemble DeckHand. Test unit for proper operation.

Case VI. DeckHand lowers anchor, but does not automatically feed out line when anchor hits bottom

Step 1. Defective momentary switch. Replace as needed.

Chapter 18.

CoPilot Wireless Accessory

Do NOT replace the complete CoPilot as a boxed marine accessory – just replace the defective part!

	P/N	Description
LEGACY:	2774023	remote/transmitter assembly
	2774031	receiver assembly (white-saltwater RipTide)
	2774033	receiver assembly (black-freshwater)
PowerDrive V2:	2774023	remote/transmitter assembly (hand-control)
	2774730	remote foot pedal transmitter assembly
	2774088	receiver assembly (black-freshwater)
	2774089	receiver assembly (white-saltwater RipTide)
Terrova:	2774095	remote/transmitter assembly
	2884090	receiver assembly

Case I. Remote is not transmitting.

Step 1. The battery may be discharged. Replace battery, if needed.

Step 2. Receiver may not have "learned" the ID number of the remote.
- **A.** Remote needs to be learned. (see **ADDING / REMOVING REMOTES** below)

Step 3. With the foot pedal connected, the MOM-CON switch is in the CON position. An audio response will be heard if a button is pressed with the foot pedal in the CON position.
- **A.** The foot pedal switch must be placed in the MOM position. The receiver will not accept any commands from the remote with the switch in the CON position.

Step 4. If remote has been taken apart, the keypad and top case may have been installed backwards.
- **A.** Take remote apart (see **BATTERY REPLACEMENT** below) and reinstall case halves with the proper orientation.

Case II. Multiple receivers have failed / been replaced on a customer's CoPilot / trolling motor combination.

Step 1. Replace the servo motor in the drive housing assembly (or complete drive housing assembly) on the trolling motor. It is suspected that the transient voltage suppressor (TVS) on the servo motor is faulty or damaged.

Case III. Terrova motor equipped with CoPilot, but CoPilot doesn't work.

Step 1. Remove right motor sideplate and inspect network connection from CoPilot receiver board to main control board. Check to ensure that the five plug pins (on the main control board side) are not missing or bent and that the plug connection is fully engaged and properly seated. NOTE: when fully engaged, no yellow space will be seen between the plug ends and the plug connection will "snap" twice as they are pushed together. Reconnect power to motor or deploy motor to turn on the system ready LED and enable the system. Test for motor function using CoPilot remote transmitter. If motor does not function proceed to **Step 2**.

Step 2. Test motor with known good corded foot pedal. If motor functions properly with test pedal, the CoPilot remote transmitter may be faulty. Disassemble the transmitter to check battery voltage (battery is 3-volt lithium coin cell). Replace battery if voltage is low. Inspect the gold plated switch contacts on the transmitter circuit board for corrosion. If any corrosion is noted, replace the transmitter. Clean the conductive rubber contacts on the transmitter switch pads with rubbing alcohol. Reassemble and retest.
- **A.** If motor still does not respond to the remote transmitter try "relearning" the receiver to the transmitter.
- **B.** If motor still does not respond, then reprogram/relearn the receiver to a known good remote transmitter.
- **C.** If the CoPilot responds properly, the customer's transmitter is faulty and needs to be replaced.
- **D.** If, after "learning" or programming the receiver to the "test" transmitter it still does not function, the CoPilot receiver board is faulty and needs to be replaced.

Audio Pattern	**What Condition Causes It**	**Occurs in Which Audio Mode**
When receiver is powered up, it sounds a beep pattern. (1 long beep, 2 short beeps, pause, repeat)	The foot pedal MOM-CON Switch is in the CON position.	All
2 second long beep	Every time the receiver is powered up and there are no remote IDs learned.	All
5 beeps	Foot pedal speed control is moved after speed has been adjusted with remote.	All
Steady tone	Hear while holding down the learn button on the receiver.	All
4 beeps	After a remote button is pressed while the receiver learns its ID.	All
A ten second long warbling sound that transitions into a steady tone.	Heard during the process used to clear all stored remote IDs. After the learn switch is released, a 2 second long beep will be heard.	All
1 beep	Pressing the INCREASE SPEED or DECREASE SPEED button.	Modes 2 and 3
1 beep	Pressing the PROP ON/OFF button to turn the prop on.	Modes 2 and 3
2 beeps	Pressing the PROP ON/OFF button to turn the prop off.	Modes 2 and 3
Single tick every 1.5 seconds	When the prop is active including when speed is set to 0.	Mode 3
1 beep	Switching to Audio Mode 1 (pressing the INCREASE SPEED and DECREASE SPEED buttons simultaneously for 1 second).	All
2 beeps	Switching to Audio Mode 2 (pressing the INCREASE SPEED and DECREASE SPEED buttons simultaneously for 1 second).	All
3 beeps	Switching to Audio Mode 3 (pressing the INCREASE SPEED and DECREASE SPEED buttons simultaneously for 1 second).	All
1 chirp	Every time the receiver is powered up and there is at least one remote ID learned.	All

OPERATING FREQUENCY

- The CoPilot system operates on 433.92 MHz frequency. It has a 24-bit digital signal totaling 16 million possible combinations.

SYSTEM FEATURES

- CoPilot is a wireless, "plug and play" accessory that allows the angler to control most corded Minn Kota PowerDrive or PowerDrive AutoPilot trolling motors from anywhere on the boat.
- CoPilot may be used with or without the corded foot pedal.
- Legacy CoPilot is compatible with any PowerDrive or AutoPilot motor with the flat foot pedal plug. There is also a CoPilot system for V2 PowerDrive units and Terrova models.
- CoPilot will not affect AutoPilot operation.
- Up to 10 remotes may be used interchangeably with the same receiver.
- The CoPilot provides finer steering control than the corded foot pedal.
- The receiver and remote are environmentally sealed and will not be affected by rain, wind or snow.
- System includes three rod mounts which allows the angler to move the remote from rod to rod.

MISCELLANEOUS INFORMATION

- The five buttons are for PROP ON/OFF, STEER LEFT, STEER RIGHT, INCREASE SPEED, and DECREASE SPEED.
  (Terrova CoPilot has two additional buttons – HIGH BYPASS and AUTOPILOT ON/OFF.)
  (If the Terrova model does not have AutoPilot, the AUTOPILOT ON/OFF button will be non-functional.)
- Pressing the PROP ON/OFF button will turn the propeller on or off. The button does not need to be held down.
  (Press the button once to turn the motor ON; press button a second time to turn it OFF.)
- Pressing either STEERING button will cause the motor to turn in the desired direction as long as the button is held down. If a steering button is held for more than seven seconds, the steering will automatically stop.
- Pressing and releasing the INCREASE SPEED or DECREASE SPEED buttons will cause the speed to increase or decrease by one level. The speed is adjustable from level 0-10. (The prop will not turn at level 0.)

GENERAL OPERATION Using the CoPilot with the corded foot pedal

- When the MOM-CON switch is in the MOM position, the angler may begin using the remote at any time.
- As soon as any remote button is pressed, the initial speed setting will be approximately the same as the foot pedal's speed control position. However, the prop will not automatically turn on until the remote's prop on/off button is pressed.
- Pressing the corded foot pedal switches will override the remote and receiver function and control will automatically go to the corded foot pedal. The prop speed will also revert to the current position of the speed control on the foot pedal.

ADDING / REMOVING REMOTES

- The CoPilot kit already has the receiver "learned" to the ID number of the remote it is packaged with.
- To "learn" the ID number of additional remotes, follow these steps:
  1.) Press and hold the LEARN button located on the side of the receiver (receiver will emit a continuous tone.)
  2.) Press any button on the remote (receiver will beep 4 times confirming that it has "learned" the ID number of the remote and that the programming is valid and complete.)
- "Re-learning" the ID number of the same remote will not overwrite previously "learned" remotes.
- If the receiver has "learned" the ID number of ten remotes, "learning" an eleventh remote will erase or over write the first "learned" remote.
- The CoPilot allows the angler to erase all stored remote ID numbers fro the receiver. To do so, follow these steps:
  1.) Remove power from the receiver by unplugging the receiver from the motor.
  2.) Press and hold the LEARN button and power up the receiver by plugging it back into the motor. Hold the learn button down for 10 seconds. During this time the receiver audio will emit a warble sound, slowly transitioning to a constant beep, and then shut off.
  3.) Release the LEARN button and the receiver will reboot. The receiver will chirp 4 times followed by a 1 second long beep indicating memory is empty. This audio pattern will occur each time the receiver powers up until a remote ID number is learned.

AUDIO MODES UNIT IS FACTORY PRE-SET TO AUDIO MODE 2.

- There are three receiver audio modes available. To switch from one audio mode to another, press and hold both the INCREASE and DECREASE speed buttons on the remote down for one second. The receiver will respond with 1, 2, or 3 audible beeps indicating the corresponding receiver audio mode change.

  Audio Mode 1 = All of the normal audible sounds mentioned in this owners manual.
  Audio Mode 2 = Same as audio mode 1 plus an audible beep for speed increase / decrease and prop on/off.
  Audio Mode 3 = Same as audio mode 2 plus the prop on audible click every few seconds.

NOTE: when the corded foot pedal is in control and the propeller is on, the prop on indicator click will be heard if the receiver is set to audio mode 3.

BATTERY REPLACEMENT THE REPLACEMENT BATTERY MUST BE A MODEL CR2032 COIN CELL TYPE

1.) Temporarily ground yourself by touching a grounded metal object in order to discharge any static electricity in your body.
2.) Remove the four screws on the bottom of the remote case.
3.) Separate the case halves to access the circuit board.
4.) Pull back the retaining fingers of the battery holder to remove the battery (underside of circuit board).
5.) Install the new battery with the positive (+) side of the battery facing up (away from the circuit board). Ensure battery is snapped securely in place.
6.) Reassemble the remote. Note that the alignment peg in the remote case must line up with the corresponding alignment hole in the circuit board. Also note that the keypad must be positioned so that the buttons are over the end of the circuit board opposite from the alignment peg and hole. Reinstall the four case screws and tighten them as required.

Chapter 19.
E-Drive Electric Outboard

In order to properly diagnose and service E-Drive electric outboard motors we would advise that you have the following on hand:

1. A 48-volt power supply or 4 series linked 12-volt batteries.
2. A "test" p/n 2770216 E-Drive throttle assembly.
3. "Test" throttle cables, p/ns 2041401 and 2041402.
4. A good quality VOM.
5. Ordinary hand tools, such as Phillips screwdrivers, pliers, wire crimpers, wrenches, etc.

Case I. Motor does not run / does not respond to throttle commands

Step 1. Check to ensure proper polarity and voltage, (48 volts), at the E-Drive battery leads. Inspect all battery leads. Inspect all battery connections (including the series connection between the four 12-volt batteries) for corrosion and security. Check for any circuit breakers installed in the E-Drive power leads or series connections. If push-to-reset breakers have been installed, check to see if they have tripped open and reset, if needed.

Step 2. Make sure master key switch is in the ON position. **(see Figure 1 page 19-2)**

A. If an "N" icon is displayed on LCD when master key switch is turned ON. Throttle control lever is not in neutral position. Place throttle control lever in neutral position to reset system.

B. If the "Prop Obstruction" icon is displayed when the master key switch is turned ON:

B-1. Move throttle control lever to neutral
B-2. Tilt motor up
B-3. Turn master key switch "OFF"
B-4. Free obstruction
B-5. Turn master key switch "ON"
B-6. Lower motor
B-7. Re-test for proper operation.

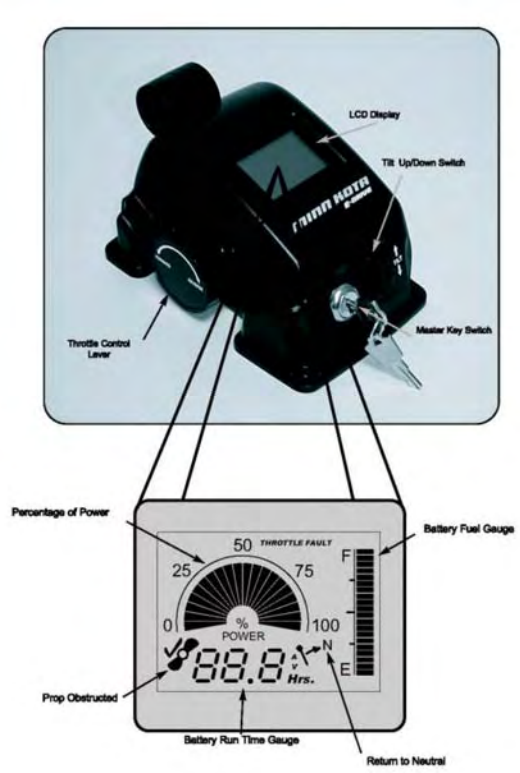


Figure 1

Step 3. Make sure that the E-Drive throttle assembly is properly plugged in. Remove the throttle cable plug from the underside of the throttle assembly and examine the throttle cable pins in the throttle assembly for damage/straightness. (Several dealers/riggers have bent the pins in the throttle assembly when attempting to connect the throttle cable.) Be sure to line up the polarizing key in the plug and receptacle before pushing together then twist the plug collar to secure the connection. If the pins are bent or damaged, the throttle assembly will need to be replaced.

Step 4. Check the throttle cable along its entire length for damage or cuts. (We have received reports of throttle cable being damaged/chewed/cut by rodents or squirrels.)

A. Perform a continuity check on both throttle cables (p/n 2041401 & 2041402) for pin out connections **(see pages 19-10 & 19-12 for pin-out diagrams)**. Continuity should be noted from one end of the throttle cable to the opposite end across the pins indicated and ONLY those 2 pins, no other should show continuity. If continuity is not found at all pins as noted in the pin-out guide or if continuity is noted across more than 2 pins, then the throttle cable is defective and needs to be replaced.

Step 5. Check for proper voltage and polarity at the contactor and main control board input terminals **(see wiring diagrams on page 19-8 and 19-9)**.

A. Remove the E-Drive control board shield assembly to expose the main control board and contactor.

B. Visually check to see that all wires are securely attached to the proper terminals.

C. Inspect main control board for any visual damage, replace control board if any burned spot, evidence of overheating, or short circuit is noted.

D. With the E-Drive motor connected to a known good throttle assembly or a "test" throttle assembly, and connected to 48 volts, check for motor function. If the motor works with the "test" throttle assembly the customer's throttle assembly is faulty and needs to be replaced. If motor does not operate with the test throttle use a VOM to measure the voltage across the *B*- terminal and the front post of the contactor. (Depending on battery state of charge a voltage of 47-52 volts should be seen.)

E. If "test" throttle assembly is not available and the customer's throttle assembly is being used, turn the E-Drive throttle assembly key switch to the "ON" position. When the switch is turned on an audible "click" should be heard at the contactor.

E-1. If audible "click" of contact engaging is not heard the cause could be a faulty key switch, damaged/corroded/broken throttle cable wires or connector pins, a faulty control board, or a faulty contactor. Test as follows to determine which part(s) need to be replaced:

a. Disconnect throttle cable from throttle assembly and examine the twelve (12) pins and sockets for damage, corrosion, misalignment, and breakage. Replace throttle assembly /throttle cable if damage is found. If no damage found, turn the key switch "ON" and use a VOM to check continuity across pins 11 and 18 on the throttle assembly **(see page 19-13 for pin-out diagram of throttle assembly)**.

a-1. If no continuity is found, key switch is faulty and needs to be replaced.

a-2. If continuity is found, reconnect throttle cable and go to **Step 5E-1b**.

b. Locate the large connector plug in the throttle cable. Disconnect the plug and examine the eleven (11) pins and sockets for corrosion, misalignment, or breakage. Replace if damage is noted. With key switch "ON" use a VOM to check for continuity across pins 7 and 15 on the plug end coming from the throttle assembly **(see page 19-12 for p/n 2041402 throttle cable pin-out diagram)**.

b-1. If no continuity is found, this section of the throttle cable is faulty and needs to be replaced.

b-2. If continuity is found and the female socket plug end appears sound, reconnect the throttle cable plug ends and go to **Step 5E-1c**.

c. If you have not already done so, remove the p/n 2770222 shield assembly (black plastic cover) from the back of the E-Drive main extrusion to expose the control board. Locate and remove the throttle cable plug connector from the control board and examine the eleven (11) pins and sockets for corrosion, damage, misalignment, or breakage. Replace as needed. With key switch "ON" use VOM to check for continuity across pins 8 and 10 on the plug end coming from the throttle assembly **(see page 19-10 for p/n 2041401 cable pin-out diagram)**.

c-1. If no continuity is found this throttle cable section is faulty and needs to be replaced.

c-2. If continuity is found, go to **Step 5E-1d**.

d. With E-Drive motor battery leads connected to 48-volt power source (power supply or 4 series linked 12-volt batteries), turn key switch "ON" and check voltage across the brown and orange wires connected to terminals on left side of contactor.

d-1. If voltage equal to voltage of power source is noted, but no audible "click" of the contactor engaging is heard, then the main control board is good but the contactor is faulty and needs to be replaced.

d-2. If voltage equal to supply voltage of power source is not found, the control board is at fault and needs to be replaced.

F. If audible "click" is heard when key switch is turned "ON" use a VOM to measure the voltage across the *B*- and *B*+ board terminals. This voltage should equal the voltage across the *B*- terminal and the front post of the contactor. If no voltage is measured, then the contactor is faulty and needs to be replaced.

G. If in **Step 5-F** proper voltage and polarity was found at the *B*- and *B*+ control board terminals when the key switch was turned "ON", but the throttle assembly LCD does not display, the motor does not run when throttle lever is advanced, the tilt system does not function, and all throttle cable connectors, pins and sockets have been examined and continuity checks performed, then the main control board is faulty and needs to be replaced.

H. If in **Step 5-F** voltage was noted at the *B*- and *B*+ control board terminals when the key switch was turned "ON", the throttle assembly LCD displays, and the tilt system functions, but the motor does not run when the throttle lever is advanced, then check the main board output to the motor at the *M*– and *M*+ board terminals. If a voltage is present, proceed to **Step 6**. If no voltage is present, then the main control board is faulty and needs to be replaced.

Step 6. Test lower unit directly (bypassing the throttle assembly and control board), to determine if it runs.

A. Connect the black and red motor brush leads, (connected to the *M*- and *M*+ terminals shown on control board wiring diagram), directly to 12 volts. The motor propeller should turn at a relatively low R.P.M.

B. If the motor does not run in **Step 6-A**, a problem exists in the lower unit. Disassemble the lower unit and check for loose brush wire leads at the brush plate, damaged brushes or brush springs, brushes not making contact with the armature commutator, or armature commutator sections that are open or dead. Replace any parts found to be bad and reassemble/reseal motor lower. When reassembled/resealed, re-test motor to verify that it runs by connecting to 12 volts as per **Step 6-A**.

C. Hook the red battery lead to red brush lead (normally connected to the control board). The motor should run. If not, a problem exists in the lower unit. Disassemble lower unit and check for voltage at the brushes, water damage, brushes not making proper contact, and an open armature.

C-1. An open armature will have some segments on the commutator that are dead. If the brushes happen to stop on this open segment, it will not run. If you can turn the prop a quarter turn and the motor starts and runs fine, the armature may have an open/dead spot. Replace armature.

Case II. Tilt system does not operate

Step 1. Check all battery connections, plug connections, and terminal connections for corrosion and security. Clean, if needed, and test for function. The lift motor is a 12-volt motor.

Step 2. On some older E-Drive motors there are two tilt switches. One is located on the throttle assembly and the other on the back of the E-Drive motor. If one switch operates properly and the other does not, check for proper continuity through the malfunctioning switch. Replace, as needed, and test for proper operation. If neither tilt switch operates, proceed to **Step 3**. (*Newer E-Drive motors have only one trim switch located on the throttle assembly. **Steps 2A**, **3A**, and **3B** applies to these motors.)

A. If the malfunctioning switch is the switch located on the throttle assembly and the switch tested fine for continuity, disconnect and remove the throttle cable from the underside of the throttle assembly. Inspect the connection on the cable side for bent pins. Straighten pins or replace cable, as needed and test for proper operation. (Bent pins are considered "accidental damage" and are not covered by the warranty.)

Step 3. Disconnect the tilt actuator leads from the control board assembly. Connect the actuator leads directly to 12 volts and observe actuator for extension/retraction. Reverse polarity at the actuator leads to reverse the actuator direction of travel.

A. If the actuator fails to operate when 12 volts is connected to the leads, the actuator is faulty and needs to be replaced.

B. If the actuator functions properly when connected directly to 12 volts, but fails to operate when connected to the main control board assembly the tilt actuator circuit on the control board is faulty and the main control board will need to be replaced.

Case III. Tilt gauge, (if motor is so equipped), does not operate

Step 1. Check battery connections on backside of tilt gauge. The tilt gauge must be connected to 12 volts in order to function. Note, power for the trim gauge can be supplied by the boats accessory wiring circuit or one of the series linked 12 volt batteries used to power the E-Drive motor. If one of the E-Drive batteries is used to power the tilt gauge we suggest an on/off switch be installed in this 12 volt tilt gauge electrical circuit.

Step 2. Check connections from sending unit to back of tilt gauge for corrosion and security. Clean if needed and test for function.

Step 3. Observe the tilt gauge sending unit lever arm as the motor is being tilted up or down. The lever arm should contact the E-Drive motor main extrusion and move/rotate as the motor is tilted up or down. If it fails to rotate check the sending unit spring for proper installation and position.

A. The tilt gauge sending unit is a potentiometer and a simple resistance check can be performed to determine if it is good or bad. Connect a VOM to the 2 leads coming from the sending unit and move the spring loaded sending unit arm. A changing resistance value should be noted as the arm is moved. If not the sending unit is faulty and needs to be replaced.

B. If the sending unit checks ok and proper voltage and polarity is provided to the gauge but the gauge fails to function, then the gauge is faulty and needs to be replaced.

Case IV. Throttle LCD "Fuel Gauge" does not show "full tank"

Step 1. Check combined battery voltage (or the voltage at each battery and sum the total). The combined voltage required to show Full, ¾, ½, ¼, and Empty are listed below:

F	(Full) = 51.96 volts
-	(3/4) = 50.76 volts
-	(1/2) = 49.56 volts
-	(1/4) = 48.36 volts
E	Empty = 47.16 volts

If, after being recharged, the combined battery voltage does not reach or exceed 51.96 volts the batteries and/or battery charger(s) are at fault. After recharging, all four batteries should be at 12.99-13 volts each or slightly higher. If one or more batteries are not at this value, they will need to be replaced and the charger output for those batteries will need to be checked (and replaced, if necessary).

Case V. Throttle LCD "Fuel Gauge" shows "full tank" when turned on, then after running for a short period of time the key switch is turned OFF then back ON the "Fuel Gauge" only shows ½ full.

Step 1. Condition described is normal. When the key switch is first turned ON (after recharging), the microprocessor on the main control board takes a reading of the combined battery voltage and displays the appropriate "fuel gauge" reading (i.e. 51.96 volts equals a full "tank" reading). This information is then used by the microprocessor to establish a battery run time and discharge profile based on the speed setting and amp draw of the motor.

After running a short period of time, if the key switch is turned OFF and then turned back ON the microprocessor again checks voltage. Now the combined battery voltage has been lowered due to the motor having been operated. The new fuel gauge reading will be represented on the LCD and the microprocessor will establish a "new" battery run time and discharge profile based on the lower battery voltage. However, this "new" run time and discharge profile will not be truly accurate as the combined available amperage from the batteries will be greater than is indicated by the batteries "float" voltage.

For this reason, we would suggest that the key switch not be turned off while the E-Drive motor is being used for a boat outing. Not turning the key OFF will allow the microprocessor to use the initial voltage profile for more accurate "fuel gauge" and run time values.

Case VI. Throttle LCD only displays "Throttle Fault" when key switch is turned ON.

Step 1. Throttle Assembly is faulty and needs to be replaced. Replace with known good/new Throttle Assembly and re-test for proper operation.

Step 2. If problem persists, check throttle cable, cable connections, and main control bard as per the procedure outlined in **Case 1**, **Steps 3**, **4**, and **5**. Replace parts as needed.

Case VII. Throttle LCD only displays "Throttle Fault" and "Prop Obstructed" icons when key switch is turned ON.

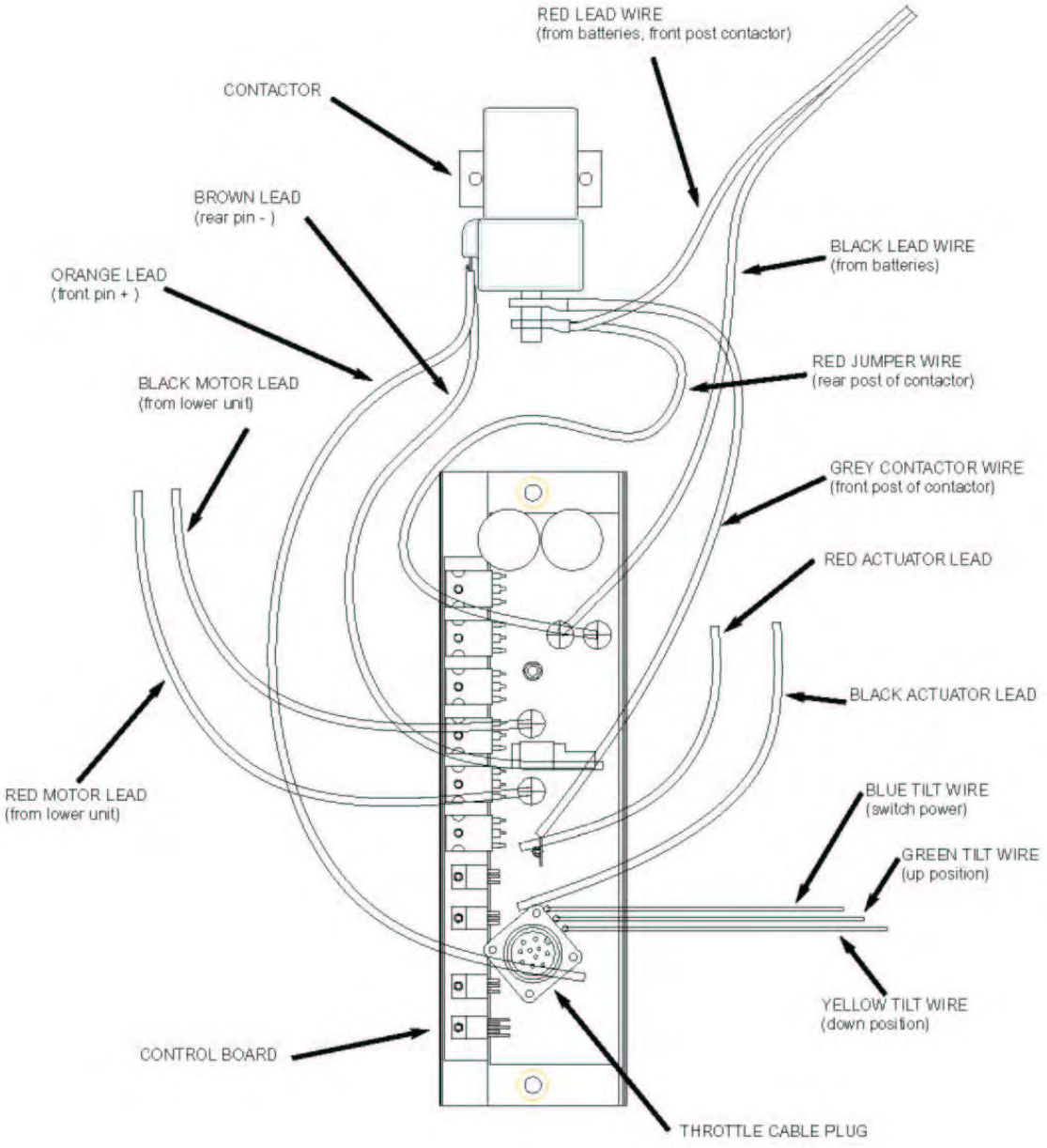
Step 1. The main control board is at fault and needs to be replaced. Replace board and re-test for proper operation.

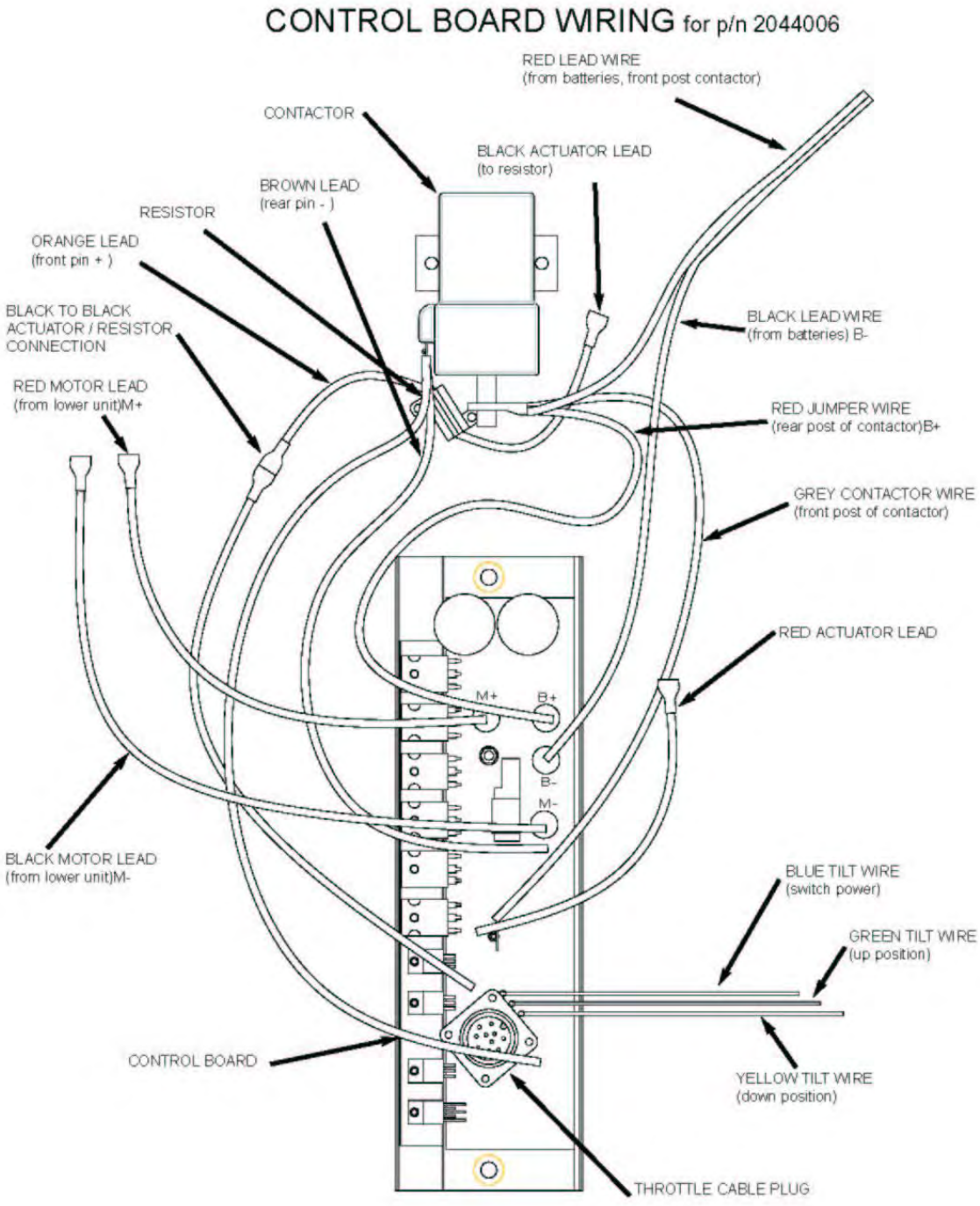
Case VIII. Throttle LCD flickers on and off.

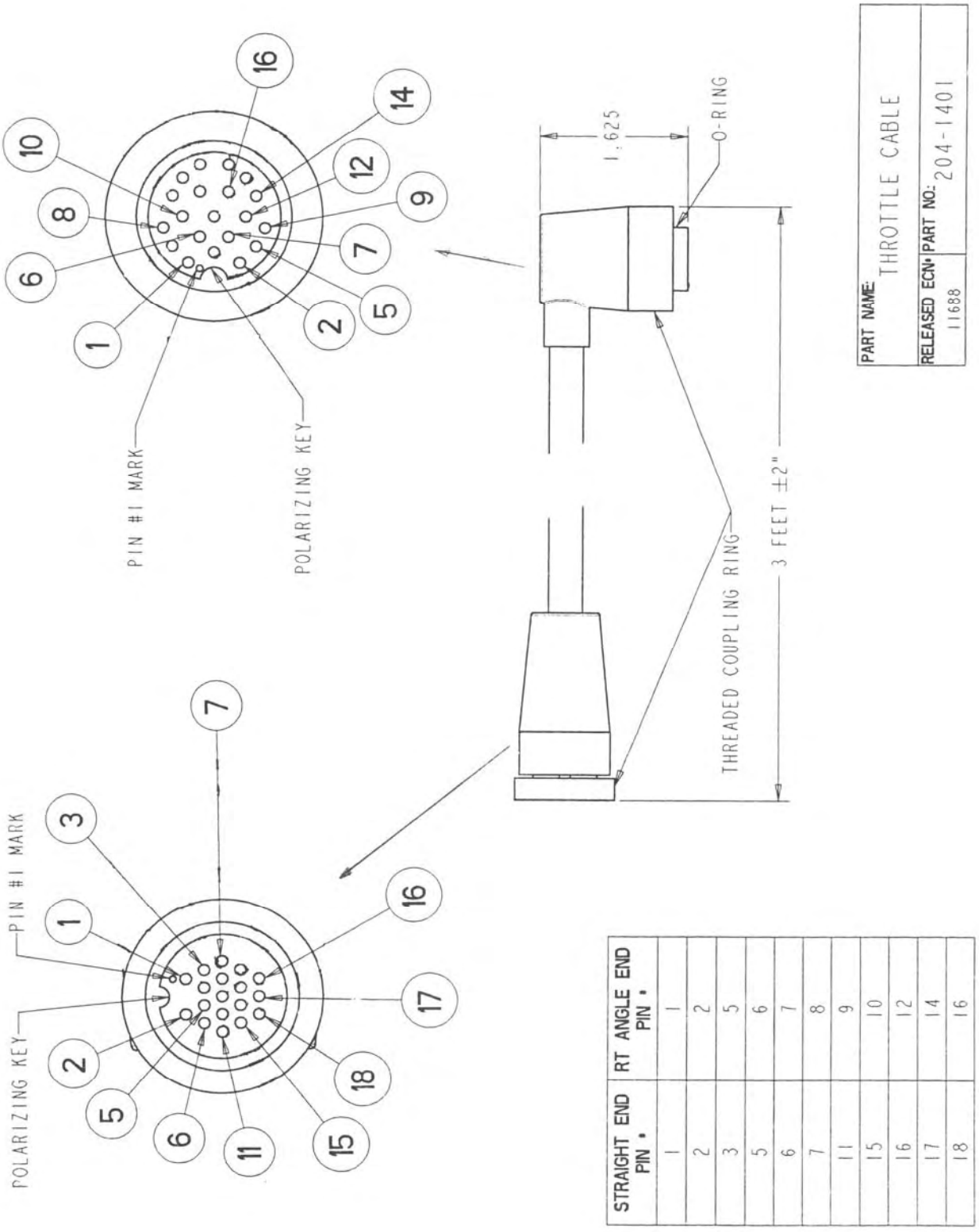
Step 1. Check all plug connections for corrosion and security.

Step 2. Perform a continuity check on both throttle cables (p/n 2041401 & 2041402) for pin out connections **(see pages 19-10 & 19-12 for pin-out diagrams)**. Continuity should be noted from one end of the throttle cable to the opposite end across the pins indicated and ONLY those 2 pins, no other should show continuity. If continuity is not found at all pins as noted in the pin-out guide or if continuity is noted across more than 2 pins, then the throttle cable is defective and needs to be replaced.

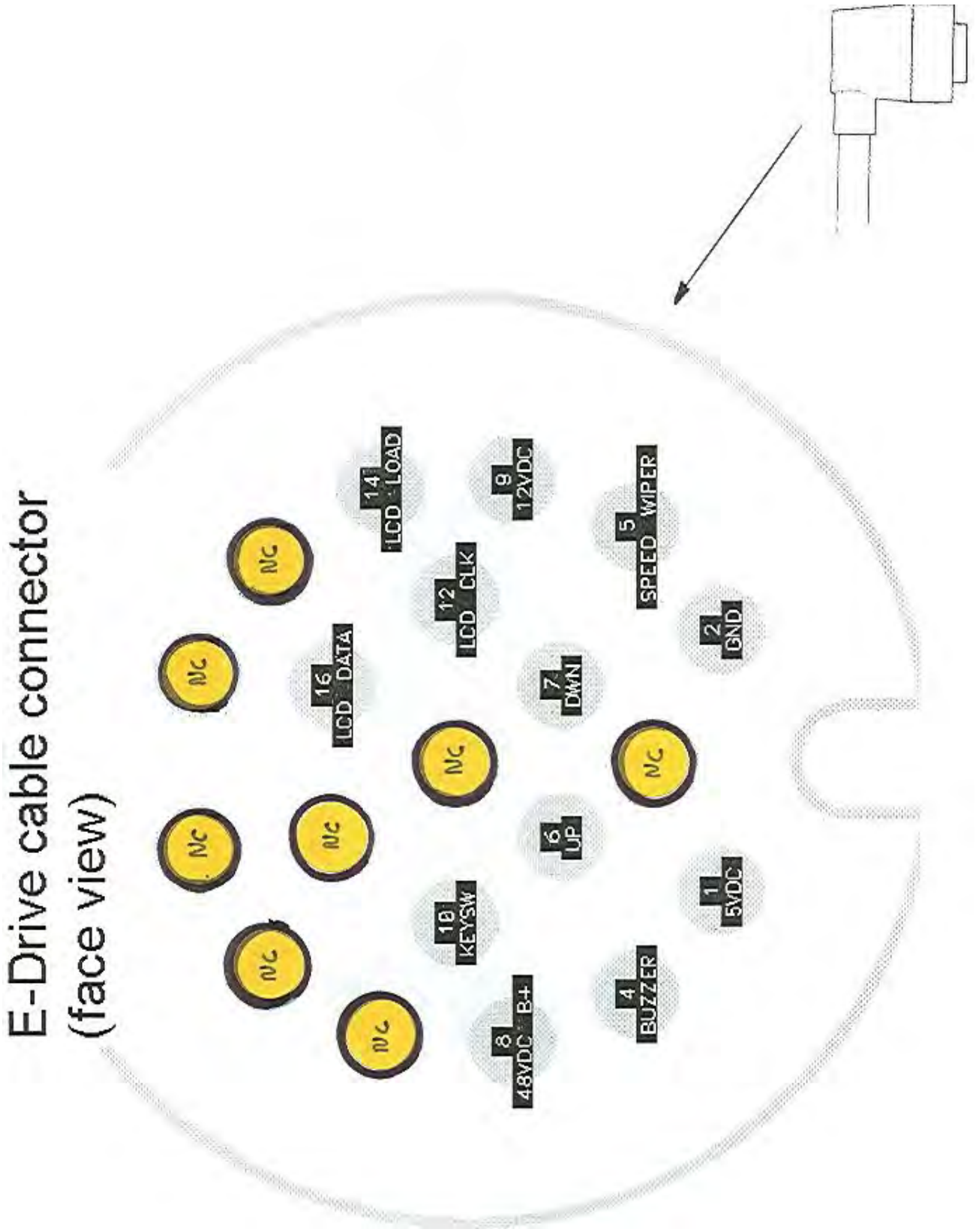
CONTROL BOARD WIRING for p/n 2044005



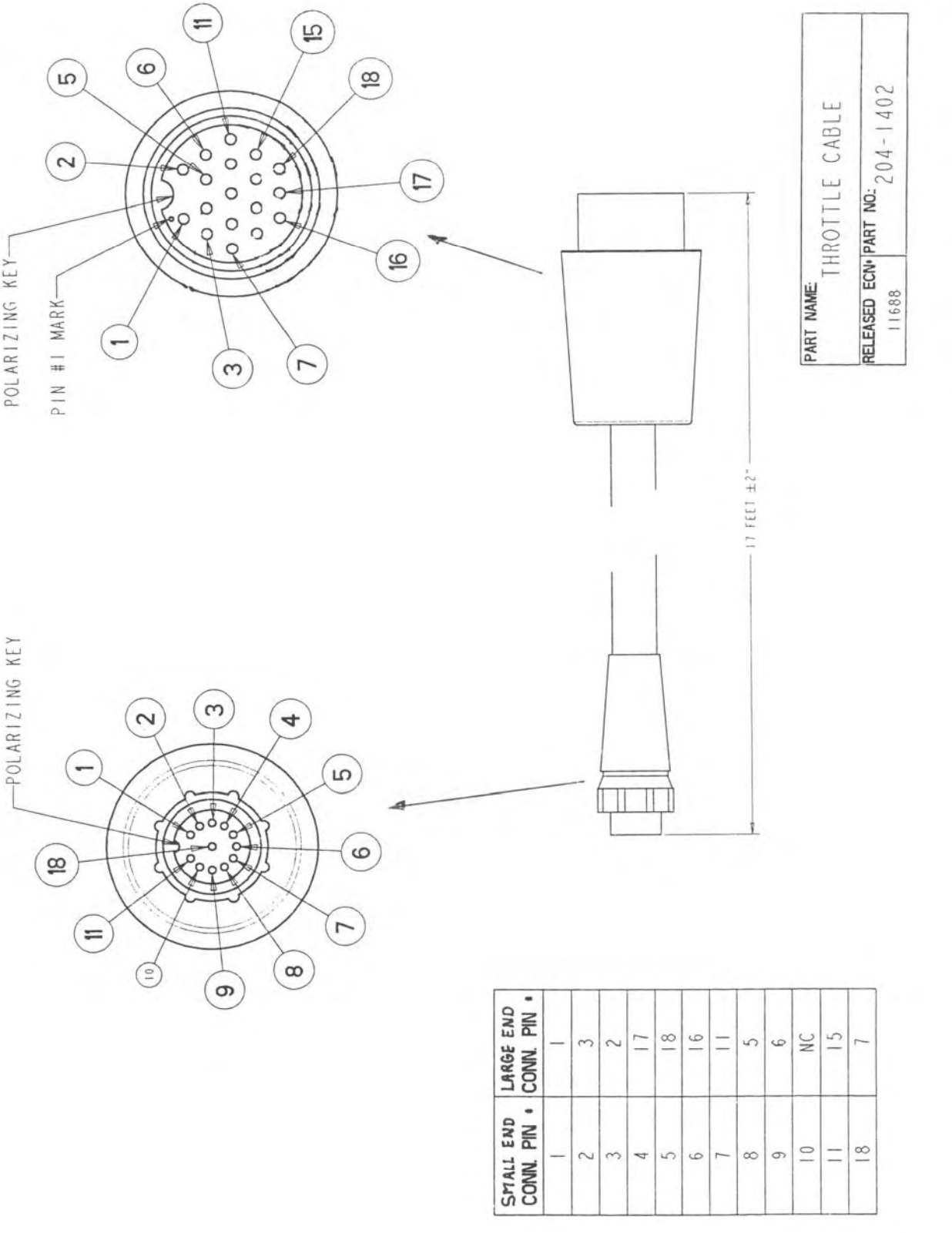

CONTROL BOARD WIRING for p/n 2044006
RED LEAD WIRE
(from batteries, front post contactor)
CONTACTOR
BLACK ACTUATOR LEAD
(to resistor)
BROWN LEAD
(rear pin -)
RESISTOR
ORANGE LEAD
(front pin +)
BLACK TO BLACK
ACTUATOR / RESISTOR
CONNECTION
BLACK LEAD WIRE
(from batteries) B-
RED MOTOR LEAD
(from lower unit)M+
RED JUMPER WIRE
(rear post of contactor)B+
GREY CONTACTOR WIRE
(front post of contactor)
RED ACTUATOR LEAD
M+
B+
B-
M-
BLACK MOTOR LEAD
(from lower unit)M-
BLUE TILT WIRE
(switch power)
GREEN TILT WIRE
(up position)
CONTROL BOARD
YELLOW TILT WIRE
(down position)
THROTTLE CABLE PLUG



Throttle Cable Pin-Out Diagram
P/N 2041401

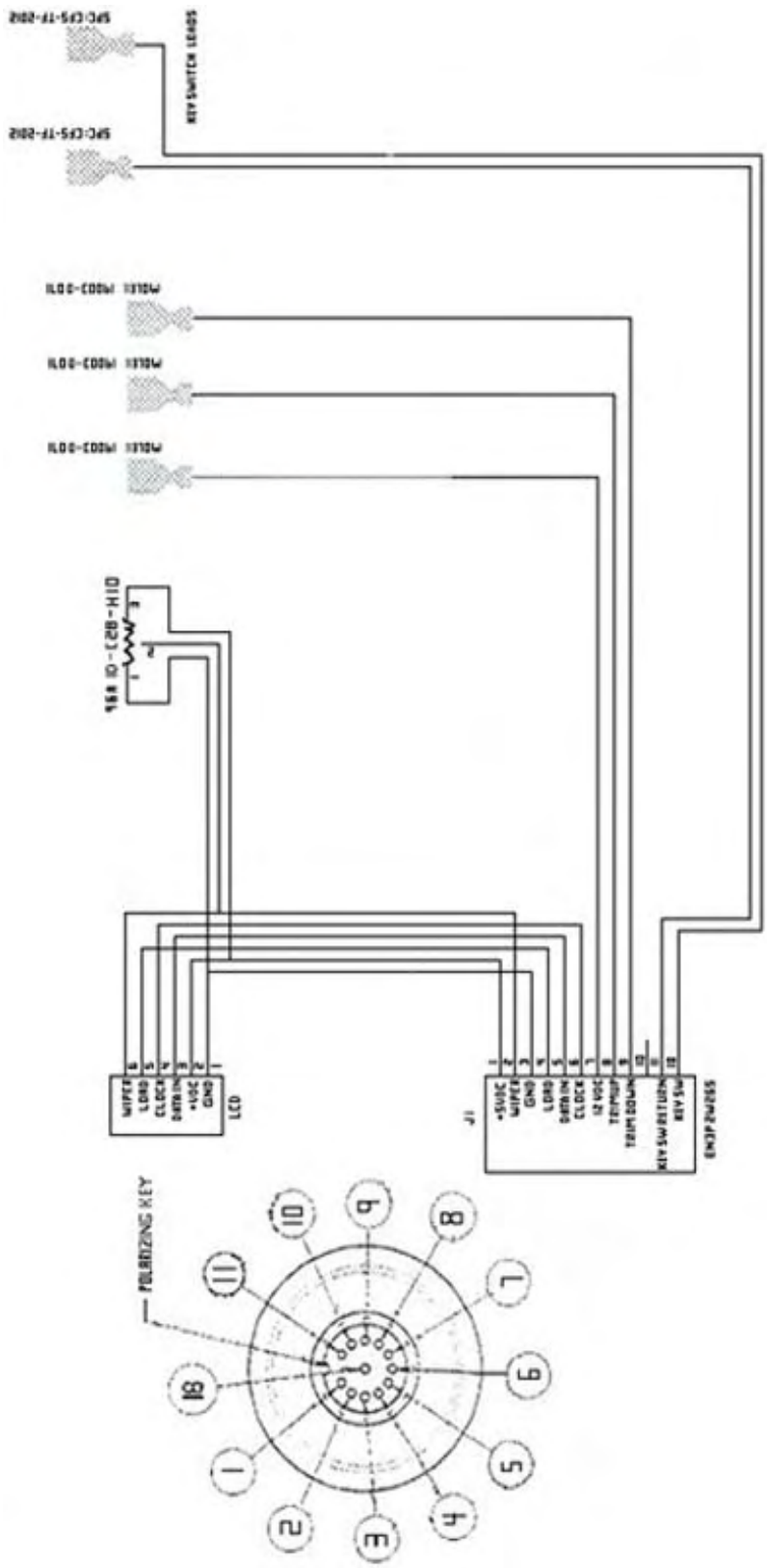


Throttle Cable Pin-Out Diagram (P/N 2041401)
(plugs into main control board)



SMALL END CONN. PIN #	LARGE END CONN. PIN #
1	1
2	3
3	2
4	17
5	18
6	16
7	11
8	5
9	6
10	NC
11	15
18	7

Throttle Cable Pin-Out Diagram
P/N 2041402



Plug Pin-Out Diagram
(on bottom of throttle assembly)

Chapter 20.

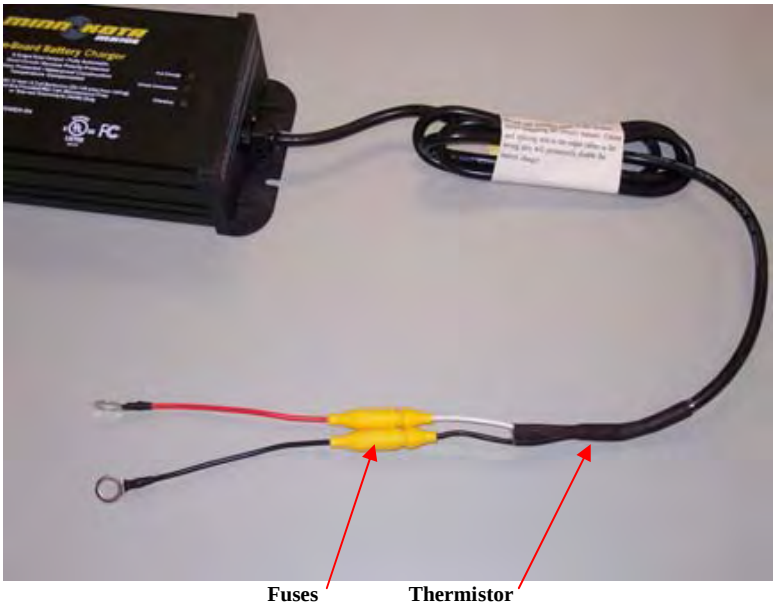
Battery Chargers

Minn Kota battery chargers are not serviceable in the field. However; by following these steps, repair centers can determine if a charger is operating properly. For safety purposes, battery chargers require at least 8 volts to be present for charging to commence.

Testing Charger for proper output

Step 1. Verify the charger battery leads are properly connected to the battery. (Red to positive, black to negative.)

Step 2. Verify the in-line 30 amp fuses are not blown and that the fuse holder is not melted. Verify that neither the AC power cord nor the DC battery output leads have been extended incorrectly (splicing the battery output leads between the charger and the thermistor voids the warranty). If the DC battery leads are not long enough, they should be brought to a terminal block and extended from the terminal block with 12 AWG (minimum) wire. The maximum extension is 15 feet. (Minn Kota offers an accessory kit for the purpose of extending the output leads.)



Step 3. Using a VOM (multi-meter), measure the voltage of the battery prior to plugging in charger. Note this measurement for future reference (must be over 8 volts for charger to operate).

Step 4. Plug in charger to 110-volt AC power (220-volt for some of the international models only). Using a VOM, again measure the voltage at the battery. The voltage should be slowly increasing as you watch the VOM. The battery voltage should continue to rise until the battery reaches the full float voltage of 13.2. (This may take several hours depending on the battery state of discharge and the specific model on-board charger being used.)

Step 5. If the battery voltage does not gradually increase when the charger is plugged in, the charger is not functioning properly OR the battery is defective.

Indicator Lights – varies depending upon model

MK105P

A YELLOW light is lit to indicate the battery is charging.
A GREEN light is lit for each bank to indicate any of the following:

A) The battery is fully charged and in maintenance mode.
B) There may be a blown fuse in the fuse holder.
C) No battery is connected to an output lead.

A RED light is lit if any of the following apply:

A) A short circuit.
B) The battery is connected reverse polarity.

MK110P and MK210P

A GREEN power light is lit to indicate AC power is applied.
A YELLOW light is lit to for each bank to indicate the battery is charging.
A GREEN light is lit for each bank to indicate the battery is fully charged and in maintenance mode.
A RED light for each bank is lit if any of the following apply:

A) No battery is connected to an output lead. This may also indicate a blown fuse in the fuse holder.
B) The battery voltage is below 8.0 volts.
C) The battery is connected reverse polarity.

MK106

A GREEN power light is lit to indicate AC power is applied.
A YELLOW light is lit or each bank to indicate the battery is charging.
A GREEN light is lit for each bank to indicate any of the following:

A) The battery is fully charged and in maintenance mode.
B) There may be a blown fuse in the fuse holder.
C) No battery is connected to an output lead.

A RED light is lit if any of the following apply:

A) A short circuit.
B) The battery is connected reverse polarity.

MK110, MK210, MK315, MK220, and MK330

A GREEN power light is lit to indicate AC power is applied.
A YELLOW light is lit for each bank to indicate the battery is charging.
A GREEN light is lit for each bank to indicate the battery is fully charged and in maintenance mode.
A RED light for each bank is lit if any of the following apply:

A) No battery is connected to an output lead. This may also indicate a blown fuse in the fuse holder.
B) The battery voltage is below 8.0 volts.
C) The battery is connected reverse polarity.

RED and GREEN lights are lit simultaneously for each bank if any of the following apply:

A) The battery voltage is below 8.0 volts.
B) A damaged temperature sensor on the output lead. The bank will not operate if this occurs.

MK230, MK345, MK460, MK440

A GREEN power light is lit to indicate AC power is applied.
A YELLOW light is lit for each bank to indicate the battery is charging.
A GREEN light is lit for each bank to indicate the battery is fully charged and in maintenance mode.
A RED light for each bank is lit if any of the following apply:

A) No battery is connected to an output lead. This may also indicate a blown fuse in the fuse holder.
B) The battery is connected reverse polarity.

RED and GREEN lights are lit simultaneously for each bank if any of the following apply:

A) A short circuit.
B) The battery voltage is below 8.0 volts.
C) A damaged temperature sensor on the output lead. The bank will stay in maintenance mode if this occurs.

Frequently Asked Questions about Minn Kota DC Alternator Chargers

Q: What is the output of the Minn Kota DC (alternator) chargers?

A: Each bank of the DC chargers puts out up to 10 amps, based on the size of the alternator and how deeply discharged the auxiliary / deep cycle batteries are. A full battery will take less current. All outputs operate simultaneously.

Q: When do the Minn Kota DC (alternator) chargers switch on?

A: The DC chargers will begin to recharge the auxiliary / deep cycle batteries when the starting battery reaches 13.6 volts. A yellow light will illuminate when the charger is recharging the auxiliary / deep cycle batteries. This ensures the boat engine driven alternator is operating and enough power is available to distribute to the auxiliary / deep cycle batteries.

Q: When do the Minn Kota DC (alternator) chargers turn off?

A: The DC charger will stop charging the auxiliary / deep cycle batteries when the starting battery voltage drops below 12.8 volts. The yellow light will turn off when the DC (alternator) charger is not recharging the auxiliary / deep cycle batteries. This will prevent the DC charger from discharging the starting battery when the boat engine is turned off.

Q: How long can the Minn Kota DC (alternator) chargers stay charging?

A: The DC charger will continue to charge the auxiliary / deep cycle batteries as long as the boat engine is running and the engine driven alternator is keeping the starting battery above 12.8 volts. It is recommended to disconnect the DC charger if the boat engine is run more than 12 hours. Batteries that are charged for an excessive period of time can lose fluid and need to be filled. NOTE: Minn Kota on-board AC battery chargers have a maintenance mode and can be left charging the batteries for long periods of time. The fluid levels of flooded lead acid, maintenance type batteries should be checked every 30 days if the AC charger is left connected and plugged in.

Q: Can the Minn Kota DC (alternator) chargers be used with my trolling motor with built in sonar?

A: Yes, each output of the DC charger is isolated from other outputs and the input. This means you do not need to connect the grounds of the starting battery to the auxiliary / deep cycle batteries like you would on other DC charging systems. Connecting the starting battery and deep cycle grounds can cause interference on integrated sonar systems. However, the Minn Kota DC chargers will still operate correctly if the grounds on your boat are connected.

Q: Can the Minn Kota DC (alternator) chargers be used on my boat where I have a battery selector switch installed?

A: Yes, the DC charger can be used with a battery selector switch. (The selector switch allows the user to connect a deep cycle battery in parallel with the starting battery.) The DC charger input and outputs are isolated and will work with the selector switch connecting batteries together.